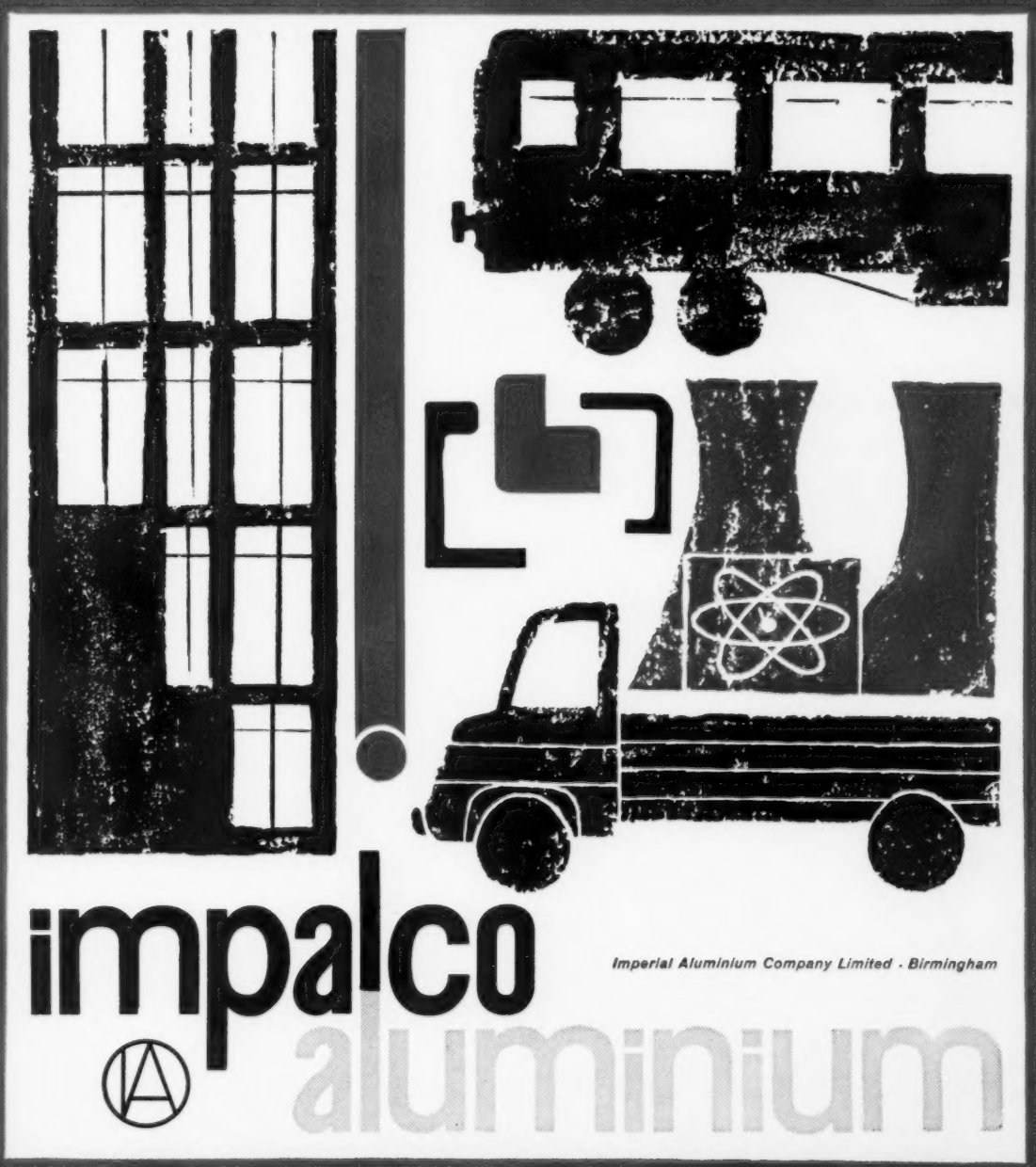
10 MARCH 1961

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



VOL 98 No 10

ONE SHILLING

METALS in all Shapes & Sizes

COPPER
ALUMINIUM
& LIGHT ALLOYS

BRASS TURNING RODS
$\frac{1}{16}$ to 8 ins.
TUBES · SHEETS · WIRES · FLAT
HEXAGON · SQUARE RODS
IN BRASS · PHOSPHOR BRONZE

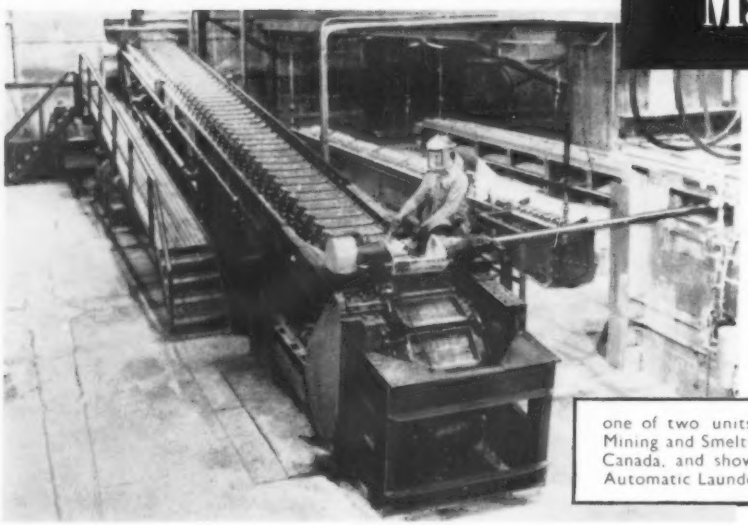
Screws · Rivets and Small Machined Parts
Matwell Frames

SHEARING & GUILLOTINING TO CUSTOMERS ORDERS

T.W. SENIER
& CO. LTD.
115-121, ST. JOHN ST.
LONDON, E.C.1.

Phone: CLErkenwell 5937 Grams: DAUNTING LONDON

Casting Machines



SHEPPARD
BOOSTER DRIVEN ZINC SLAB CASTING MACHINE

For bulk production of zinc slabs, the Sheppard Booster-Driven Casting Machine is standard equipment, where high output with traditional slab finish is essential.

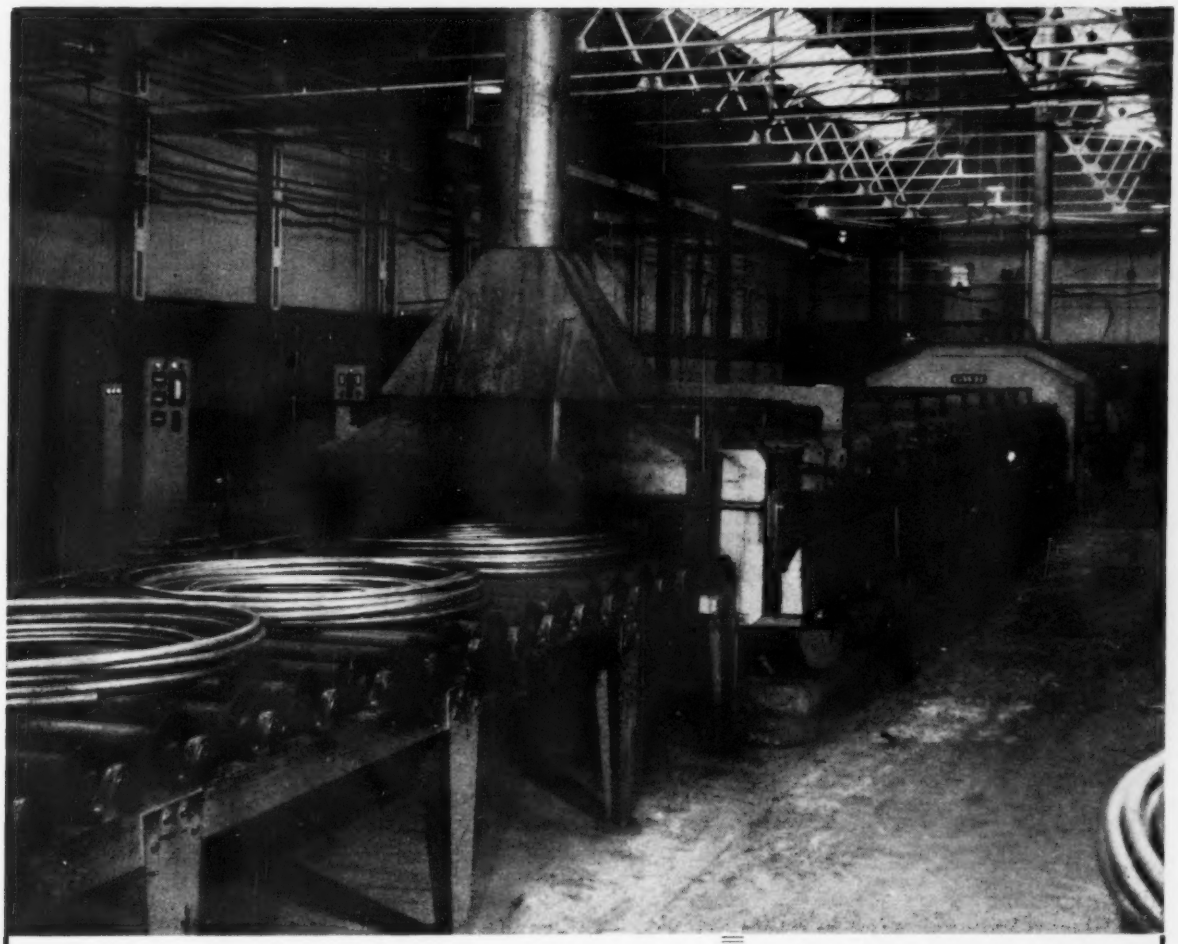
one of two units supplied to The Hudson Bay Mining and Smelting Co. Ltd., Flin Flon, Manitoba, Canada, and showing The Hot Metal Pump and Automatic Launder.

SHEPPARD & SONS LTD. BRIDGEND · GLAMORGAN

Tel: Bridgend 3201

LONDON OFFICE: SADDLERS' HALL, GUTTER LANE, LONDON, E.C.2. Tel: Monarch 7351

SHEPPARD'S of Bridgend



A G.W.B. Furnace installed at the works of EARLE, BOURNE & CO. LTD. BIRMINGHAM. This furnace is of a 2 ton per hour capacity, is atmosphere controlled and is of the Continuous Roller Hearth type. In this instance it is used for the treatment of copper and brass tubes up to 35 feet in length also for coiled tubes. Rating is 285 kW in 3 control zones, minimum temperature 700°C.

Also manufactured by G.W.B. Furnaces Ltd:—

* **BATCH FURNACES**
* **BELL FURNACES**
* **BOGIE HEARTH FURNACES**
* **PIT FURNACES**
* **MESH BELT CONVEYOR FURNACES**
* **CONTINUOUS ROLLER HEARTH FURNACES**
* **PUSHER TYPE FURNACES**
* **WALKING BEAM FURNACES**

GWB

G.W.B. FURNACES LTD.

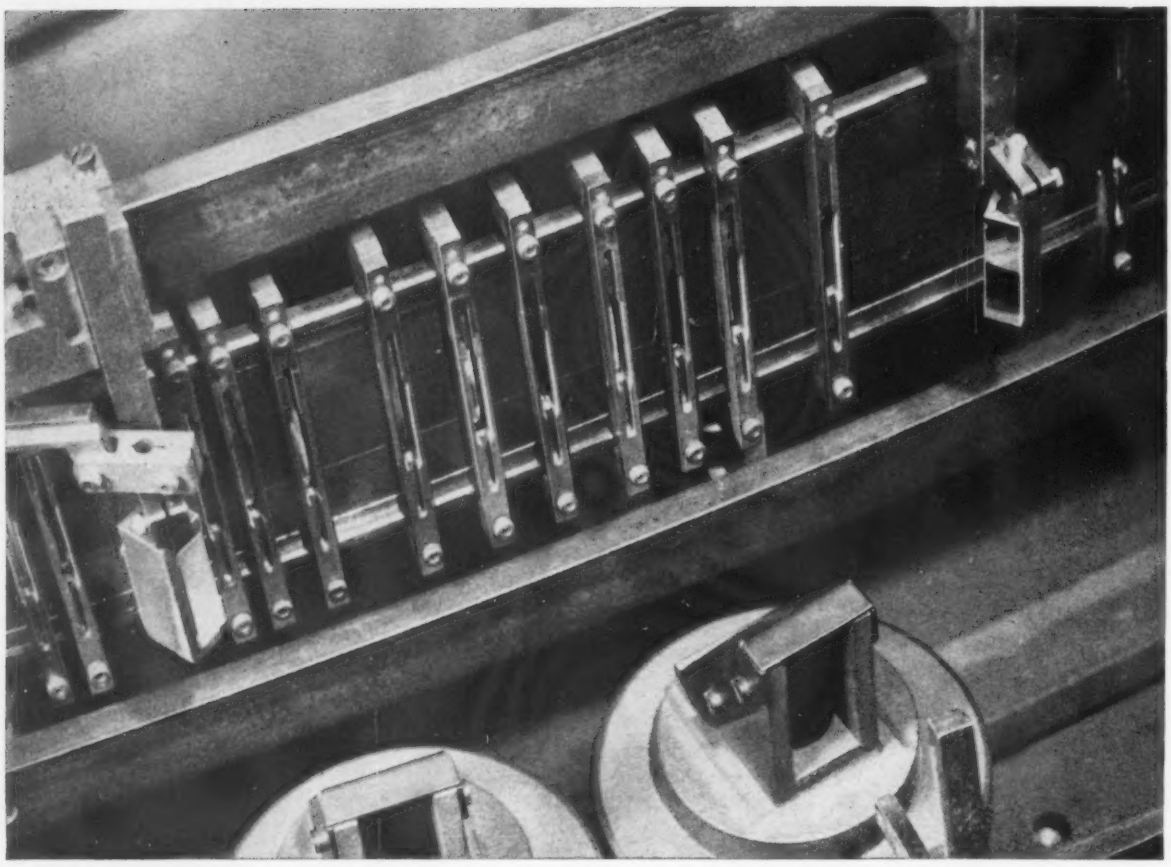
P.O. BOX 4 · DIBDALE WORKS · DUDLEY · WORCS.

Tel: Dudley 55455 (9 lines)

Associated with Gibbons Bros. Ltd. and Wild-Barfield Electric Furnaces Ltd.

GWB557

A



NO DOUBT ABOUT IT...

Some parts of an automatic spectrograph may look complicated, but no instrument could be simpler to use and maintain, and none could analyse an alloy more quickly or more accurately. Is the specification of your alloys important? Check it with an automatic spectrograph and there will be no doubt about it.

POLYSPEKS • POLYPRINTS • POLYVACS

Please write for details in catalogue CH 405/f5

HILGER & WATTS LTD HILGER & WATTS 98 St Pancras Way London NW1

Come and see it in operation at the Battersea
Test Foundry, or ask our Technical Representative to call.

The Crucible Department

THE MORGAN CRUCIBLE COMPANY LIMITED, NORTON WORKS, WOODBURY LANE, NORTON, WORCESTER. Tel: Worcester 28831. Telegrams: Crucible, Worcester

F52A

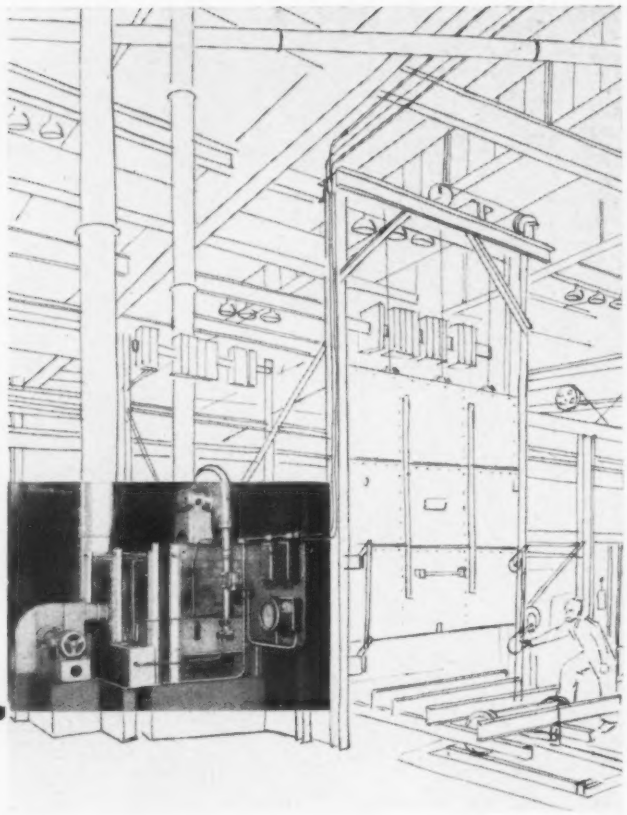
ROTAVAC Burners

- Core drying
- Malleablising
- Annealing
- Heat treatment
- Non-ferrous metal melting
- Mould drying, etc.

whichever your application ROTAVAC burners ensure Economy, Reliability and Ease of Maintenance

NU-WAY Oil-firing

Large recirculating core stove supplied to Messrs. W. & T. Avery Limited, Tame Bridge Works, Walsall by Messrs. Modern Furnaces & Stoves Ltd., Handsworth, Birmingham, 21. One Rotavac type W.3 burner operating on semi-automatic Unit Control (Nu-way Specification No. W56 C) using medium grade fuel oil.



NU-WAY HEATING PLANTS LTD.,
(Box B511), DROITWICH.

R. J. COLEY & SON (Hounslow) LTD

MILL FARM WORKS, HANWORTH RD., HOUNSLOW Tel. Hounslow 6136, 2266/7

R. J. COLEY & SON
(NORTHERN) LTD
King Street, Dukinfield
Tel.: Ashton-U-Lyne 3664

R. J. COLEY & SON
(BRISTOL) LTD
Deep Pit Road,
St. George, Bristol, 5
Tel.: Bristol 56307

R. J. COLEY & SON
(SWINDON) LTD
112 Oxford Road,
Stratton St. Margaret, Swindon
Tel.: Stratton St. Margaret 2164

R. J. COLEY & SON
(PRESTON) LTD
Stoneygate, Preston
Tel.: Preston 57621/2

COLEY UTILITIES LTD
North Drive, Hounslow
Tel.: Hounslow 9720

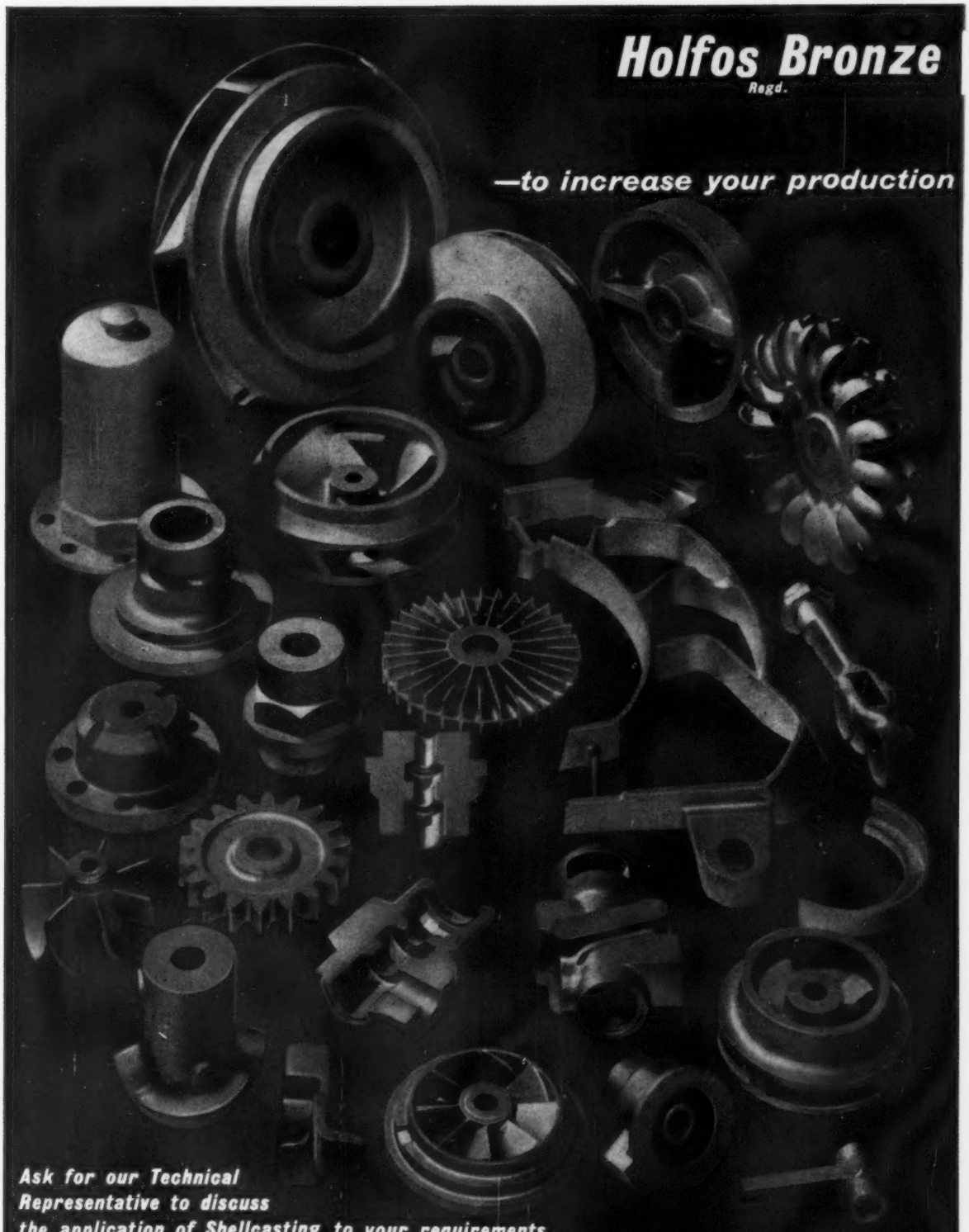
H. A. FOSTER
(CHERTSEY) LTD
Mead Lane, Chertsey
Tel.: Chertsey 2196

"Members of the National Association of Non-Ferrous Scrap Metal Merchants."

METAL MERCHANTS

Holfos Bronze
Regd.

—to increase your production



Ask for our Technical Representative to discuss the application of Shellcasting to your requirements

John Holroyd & Co. Ltd
P.O. BOX 24, HOLFOS WORKS, ROCHDALE, LANCS. Tel. 3155
BRONZE · GEARS · MACHINE TOOLS

HL 18

QUALITY...

UNIFORM

Intensive Research and Quality Control ensure that you can depend on the uniformity of

Unceasing research and strict quality control, at all stages of production, ensures that Intal Light Alloy Ingots can always be depended upon. The quality never varies. With over a quarter of a century's experience and progress, Intal maintain all the newest techniques in scientific inspection, and make use of the most advanced instrumentation in ensuring that the Intal high standard of quality is consistently maintained.

INTAL

Light Alloy Ingots

These illustrations are taken from the latest Intal booklet, giving much interesting information on alloy ingot manufacture. We shall be pleased to post a copy to executives on request.

INTERNATIONAL ALLOYS LTD

HAYDON HILL, AYLESBURY, BUCKS. Telephone: Aylesbury 4242. Telex. 83120 Cables: Intalloyd, Aylesbury

Hall-mark of fine silver in 1637

Hunt & Mitton Ltd, long-established manufacturers of high-pressure valves, put oil-fired SKLENAR furnaces in the new extensions to their foundries. The requirements were stringent. The castings produced must have a fine and even grain, be completely homogeneous, and micro-porosity completely eliminated. Hunt & Mitton took advantage of SKLENAR'S 14-day free demonstration in their foundry: the results were entirely satisfactory.

(photographs by courtesy of Hunt & Mitton Ltd.)

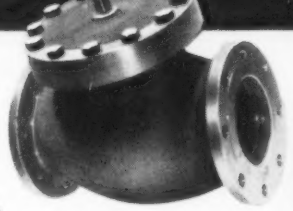


Illustration shows a 6" bore Globe Stop Valve for 275 p.s.i. Liquid Oxygen minus 130°F.

SKLENAR

mark of the efficient melting furnace today

Any SKLENAR furnace can melt a charge of bronze from 50 lbs to 5 tons in 30 minutes. *And there is no crucible to renew.*

PROVE IT IN YOUR OWN FOUNDRY

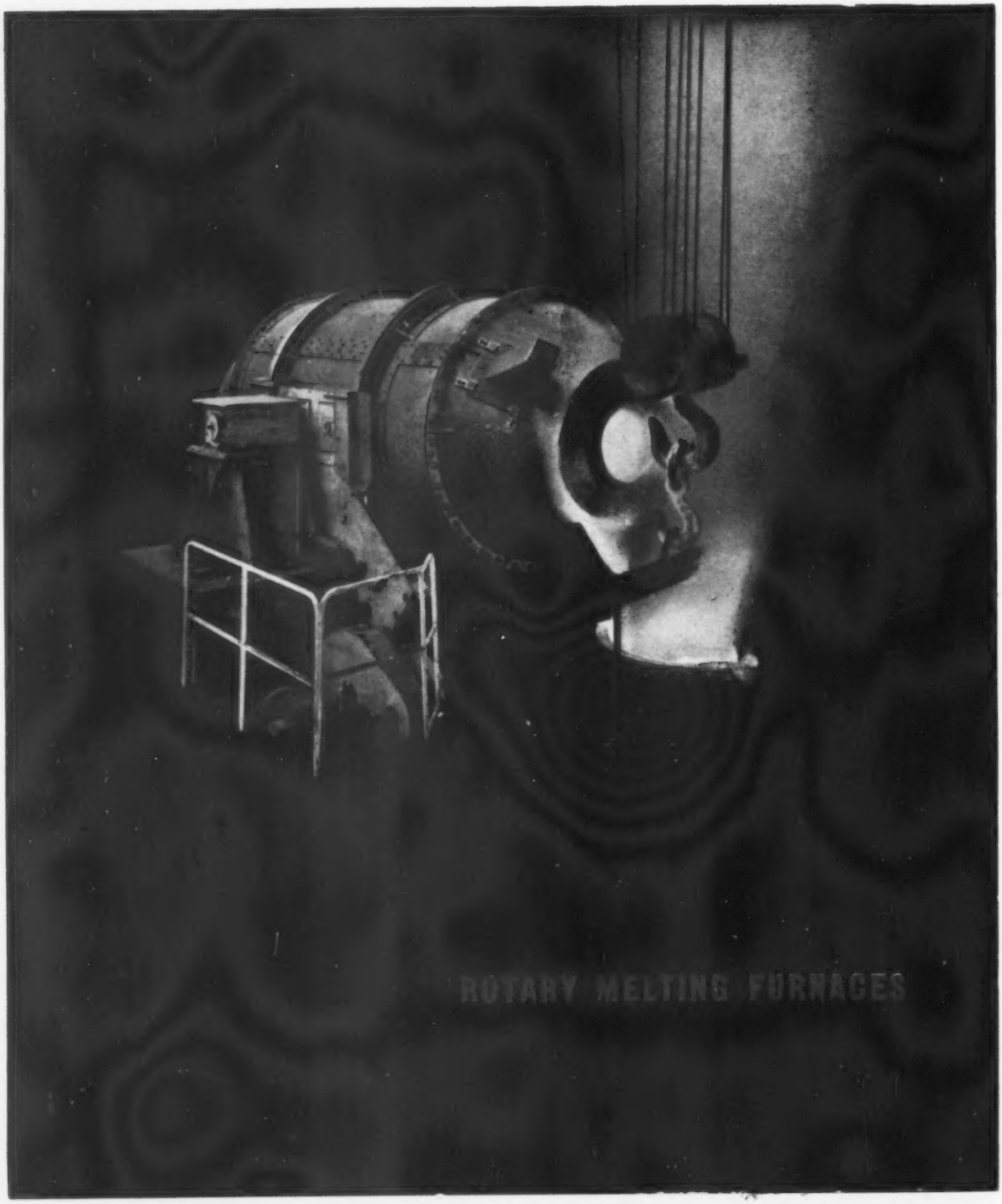
with our 14-day free demonstration offer in the U.K.

Write for free booklet "efficiency in melting"

SKLENAR FURNACES LIMITED

385 Newport Rd. Cardiff Tel: Cardiff 35645 (Private Exchange) Grams: Sklenar Cardiff

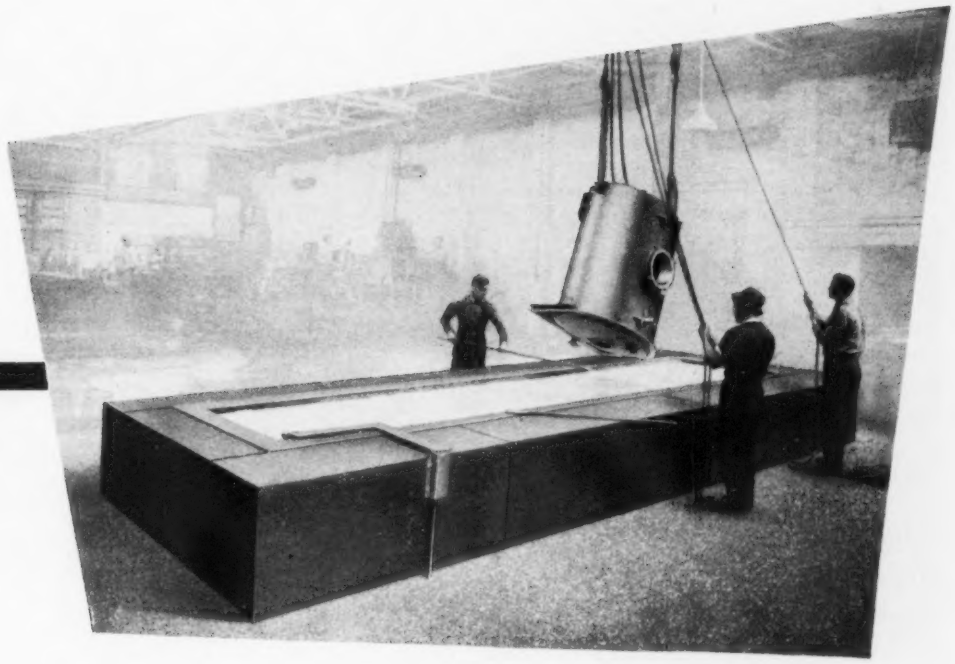
P.5815



MONOMETER MANUFACTURING CO LTD

SAVOY HOUSE, 115-116 STRAND, LONDON W.C.2.

Telephone: Temple Bar 0231 Telegraphic address: Monometer, Rand, London.



We have developed a new system for heating galvanising baths, and we claim many advantages, chief of which are:—

1 Even and precise heating of all four walls of the bath; "hot spots" and over heating are entirely precluded.

2 Full working with minimum maintenance using liquid or gaseous fuel when high CO_2 and low flue temperature readings are evident. Also suitable for electric heating.

3 The setting is made of specially treated steel. Fire brick is entirely excluded.

4 Very rapid response to the changing heat requirements of the bath is evident.

★ *For further details get in touch with us*

TANCRED & LANGLEY LTD.

BARRAS WORKS, UPPER WORTLEY ROAD, LEEDS 12

Tel:- 630291/2

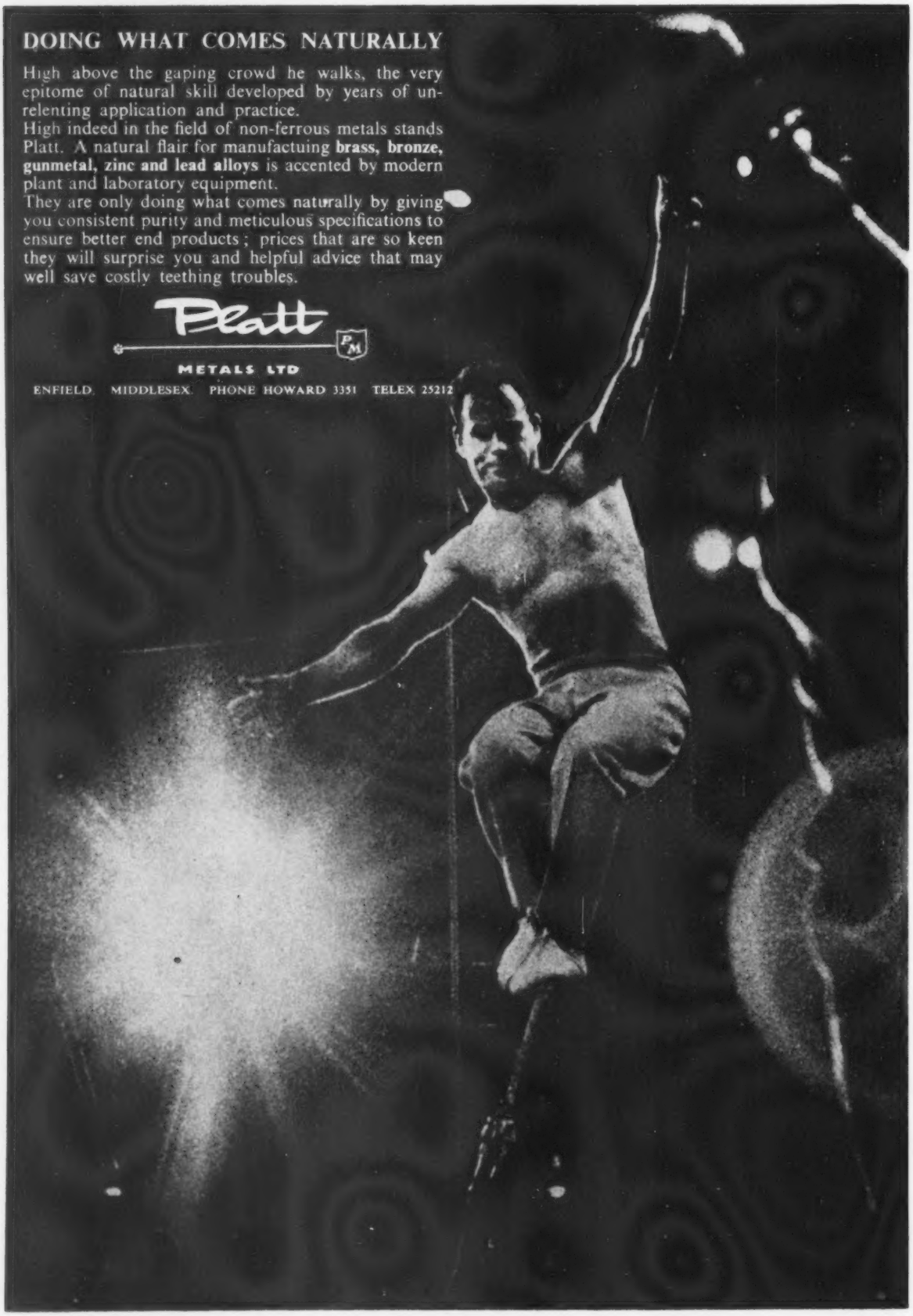
DOING WHAT COMES NATURALLY

High above the gaping crowd he walks, the very epitome of natural skill developed by years of unrelenting application and practice.
High indeed in the field of non-ferrous metals stands Platt. A natural flair for manufactuing **brass, bronze, gunmetal, zinc and lead alloys** is accented by modern plant and laboratory equipment.
They are only doing what comes naturally by giving you consistent purity and meticulous specifications to ensure better end products; prices that are so keen they will surprise you and helpful advice that may well save costly teething troubles.

Platt

METALS LTD

ENFIELD. MIDDLESEX. PHONE HOWARD 3351 TELEX 25212



METAL INDUSTRY

FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

MANAGING DIRECTOR: ARTHUR B. BOURNE, C.I.Mech.E.

10 MARCH 1961 VOLUME 98 NUMBER 10

CONTENTS

	Page
Editorial: Stress on Machines and Men	181
Out of the Melting Pot	182
Oil-Fired Furnaces. *By J. A. Taylor*	183
Men and Metals	186
Tin-Alloy Bearings	186
Atomic Progress: Corrosion of Austenitic Stainless Steel in CO_2	187
Products and Processes	188
Organic and Metallic Finishes *By R. J. Brown*	190
Micro-Tensile Testing	192
Institute of Metal Finishing Midland Branch Dinner-Dance	192
Industrial News	193
Forthcoming Meetings	195
Metal Market News	196
London	
Birmingham	
New York	
Chile	
Non-Ferrous Metal Prices	197
Scrap Metal Prices	198
Foreign Scrap Prices	199
Financial News	199
New Companies	199
The Stock Exchange	200

© Iliffe Production Publications Ltd. 1961

Permission in writing from the Editor must first be obtained before letterpress or illustrations are reproduced from this journal. Brief abstracts or comments are allowed provided acknowledgment to this journal is given

PUBLISHED EVERY FRIDAY BY ILIFFE PRODUCTION PUBLICATIONS LTD.

Editorial Offices: 9 Charlotte Street, Birmingham 3. Telephone: Central 3206

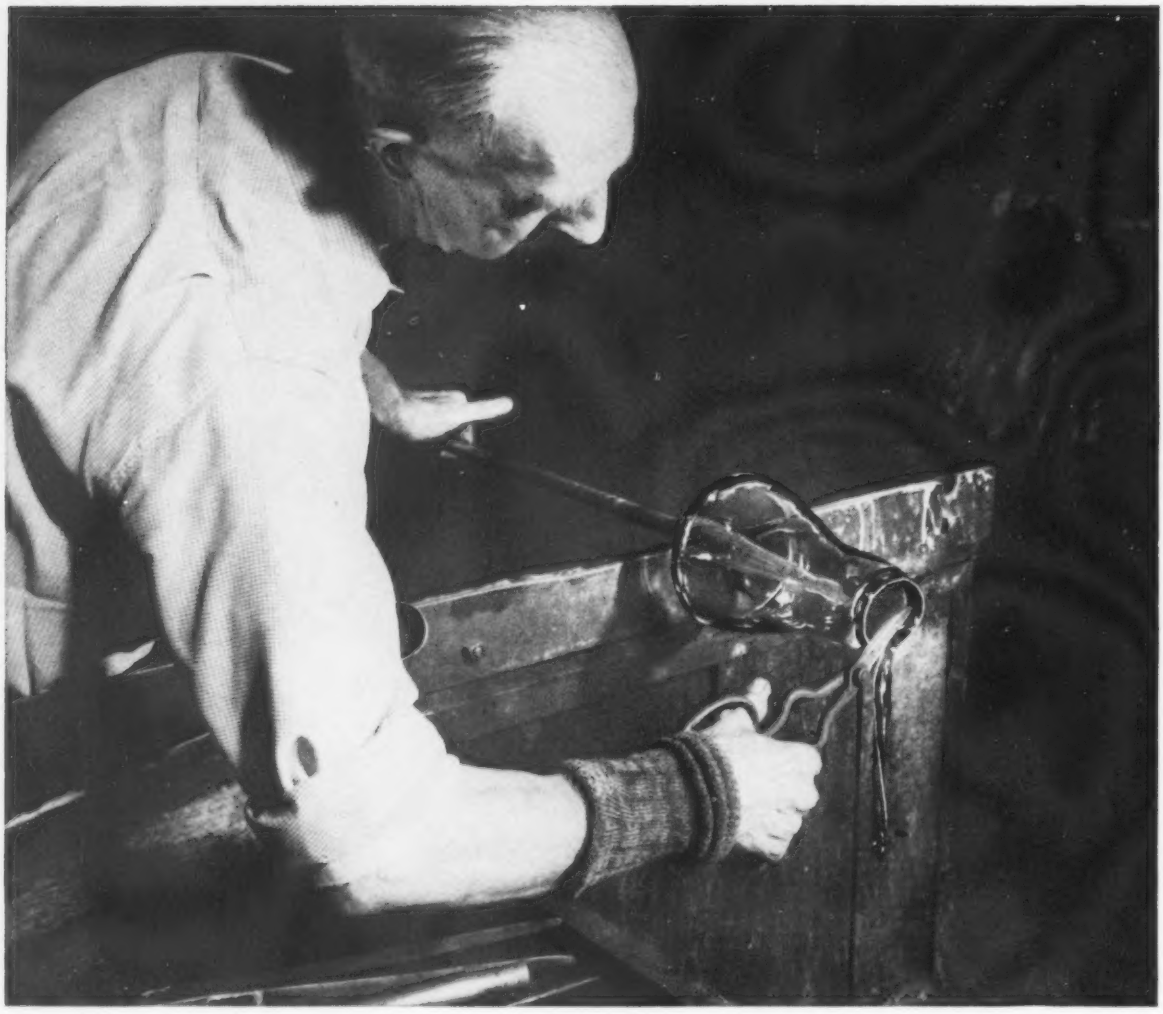
Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Tel.: Waterloo 3333. 'Grams: "Metustry, London-S.E.1"

Branch Offices: MANCHESTER: 260 DEANSGATE, 3; telephone, Blackfriars 4412 and Deansgate 3595 BIRMINGHAM: KING EDWARD HOUSE, NEW STREET, 2; telephone, Midland 7191. COVENTRY: 8-10 CORPORATION STREET; telephone, Coventry 25210. GLASGOW: 62 BUCHANAN STREET C.1 telephone, Central 1265/6

ANNUAL SUBSCRIPTION

HOME **£3 7s. 6d.** *OVERSEAS* **£3 12s. 0d.** *CANADA AND U.S.A.* **$10.00**

INCLUDING ONE COPY OF **METAL INDUSTRY HANDBOOK,** *PUBLISHED ANNUALLY*



Taking the edge off the Blow

This glass blower is putting the finishing touches to his work, for its high quality is all important. No less important is the choice of materials . . . of the metal for pressure die casting, for instance. Leading die casters put their confidence only in Mazak.

In some cases the existing procedure of a producer is accepted as the best practice of the art and is taken as a basis for the standard in question. Thus British Standard 1004 (Zinc Alloy for Die Casting) was based on the established practice of the Imperial Smelting Corporation in the production of Mazak.

MAZAK

CONSOLIDATED ZINC CORPORATION (SALES) LIMITED, LONDON W.1

METAL INDUSTRY

VOLUME 98 NUMBER 10 10 MARCH 1961

Stress on Machines and Men

ENGINEERS, when they design their machines, must take into consideration the stresses that the materials from which they are made will have to withstand. It is also equally important that they should understand the stresses that the machines are likely to impose on the human beings who will have to operate them. Man and his task must be considered as a complementary whole, and it is most important that those whose business it is to design machines which will be operated by men, or who are responsible for the organization of work, should have a grounding in the biological sciences. Only so can they have some appreciation of the stresses which the machines or tasks are likely to impose on the operators. If they lack it, there is always the possibility that there will be occasions when the demand imposed on the man will be so high that he may pass into an overload condition and disaster may result.

There is nothing very new in the studying of human performance. What is new in the concept of ergonomics is a combined approach by engineers, anatomists, physiologists and psychologists towards problems arising when man undertakes some working activity with or without a machine. That is why much interest should be taken by industrialists in the two-day Seminar on "Ergonomics—or Fitting the Job to the Worker", which has been organized by the Birmingham Productivity Association, to be held at the Chamber of Commerce at Birmingham this month.

Work study can go only part of the way towards achieving a harmonious relationship between man and his task. As time goes on, jobs are becoming less physically stressful and the load imposed on operators is becoming increasingly a mental one. To deal with problems which arise in this field and many others like them requires the specialized knowledge of the biological scientist. This can now be made available to industry either by (a) training people who are already engaged in industry as work study engineers or as designers, or (b) taking into industry people who are biological specialists and training them in the necessary industrial techniques. Before this can come about, however, it is necessary to carry conviction to those in executive positions who are in a position to decide whether the techniques are likely to be of use to them in their particular circumstances.

It is with this vital consideration in mind that this Seminar has been designed to last for two days (March 21 and 22) and is aimed at upper and middle management, including heads of production departments and senior production engineers, chief and senior work study officers, chief designers, senior draughtsmen, works managers, maintenance engineers and trade union officials. It will be realized that ergonomics covers a very wide field, and in such a short time only a small portion of the subject can be covered. The main aim of this event is to make known what does exist and show how it can be integrated with existing industrial organizations. What is particularly essential is that not only workers should fully understand the purpose of the study of human performance, but that employers also should appreciate that it concerns them equally as much.

Out of the MELTING POT

Non-Corrosion Fatigue? MENTION of corrosion fatigue normally conjures up visions of specimens being tested in a salt spray or other corrosive medium, or of structural parts operating under corrosive conditions. Drastically shortened fatigue lives are the rule in all such cases. There has also been some evidence that "corrosion" should not be overlooked in connection with the fatigue behaviour of metals tested under normal conditions, i.e. in air, although any effects of such corrosion would, of course, be a substantially constant factor in the results. Invariably, however, any such "corrosion" tends to be overlooked. From overlooking it, it is but a step to forgetting about it altogether, whereupon it becomes possible to start elaborating detailed mechanisms of fatigue crack initiation and growth, all of which involve slip and consequently the exposure of fresh clean metal surfaces to, presumably, nothing at the metal/nothing interface. It is only when the normal conditions are varied that the importance of the environment in contact with the surface of the metal becomes apparent, even when this environment is not corrosive in the usual meaning of this term. Thus it has recently been found that the water vapour in normal air significantly reduces the fatigue life of aluminium alloys (aluminium-4 per cent copper, Duralumin, and aluminium-zinc-magnesium alloys were tested). In dry environments, or with specimens protected by a coating of butyl rubber which has a low permeability to water vapour, improvements in fatigue life of about eight times were obtained. The conclusion drawn from the results was that water vapour facilitates both the initiation of fatigue cracks and their subsequent growth, presumably by interacting with the clean surfaces of metal exposed by slip. Such interaction would give rise to nascent hydrogen, and the diffusion of the latter into the metal is thought to be a significant feature of the phenomenon, though its exact mechanism still remains obscure. Now that this phenomenon has been so admirably demonstrated in real life with ordinary polycrystalline alloy specimens, it is certainly time for a detailed microscopic study of its occurrence in single-crystal aluminium specimens. Such a study might go even further and determine the undoubted effect (appreciated but not investigated in the research work referred to above) on fatigue life, even in a dry environment, of the water vapour adsorbed on the specimen.

Mere Numbers NUMBERS, however large they may grow, are certainly not the most important feature of scientific and technical literature. It is not so much the result of a growth in the number of published items on a given number of subjects as of the number of published items on a growing number of subjects. Thus, where formerly there were only a few commonly used metals and their alloys to write about, there are now quite a few more. Where formerly the number of common sheet metal working processes could be counted on the fingers of one hand, today it would take quite a time to collect them all together before starting to count them, and even then, very probably, one or two new ones would make their appearance during that time. Where formerly there was the ordinary extrusion process for the production of sections, and the impact extrusion process for the manufacture of collapsible tubes, it would be quite difficult to decide what there is now. With so much more to cover, it is not surprising that numbers increase. At the same time, also, the length of the articles devoted to individual subjects is tending to diminish. Publication by abridgement, abstract, or news item is becoming more and more common, the original source of the information very often remaining unknown, inaccessible, or even, as in the case of a talk or discussion at some meeting, non-existent. This trend towards snippets may be just what is wanted for computers, but hardly provides food for thought for intelligent readers. And if it is argued that the latter no longer have time to absorb the contents of lengthy contributions, it may equally be argued that, time or no time, it is as a result of being fed innumerable snippets that they have well-nigh lost the habit.

Manganese-Rich A SUPERFICIAL acquaintance with manganese leaves one with the impression of a metal being forever destined to play the part of an alloying element, while the possibility of its reaching the status of a metal in its own right both in the pure state and as a base for the preparation of alloys seems to be remote. Vague memories of the difficulties of preparing manganese, e.g. by electrolysis, and equally vague recollections of the properties of the metal, lend support, however ill-founded, to this impression. The non-existence of a Manganese Development Association and of a publication entitled *Manganese Abstracts* provide additional evidence. Not that such an Association would be condemned to inactivity from its inception. Given the necessary funds, it could start surveying the literature and by sponsoring research into, for example, electroplating with manganese, and the properties of electrodeposits of manganese and of manganese alloys. Then again, if the pure metal is difficult or impossible to work by ordinary methods, could not powder metallurgy make something of it or with it? Research—inspired, if necessary, by recent experience with cermets—could surely add something to the ten-year-old statement that "sintered manganese metal has not yet found any practical application, since the metal is apparently very brittle even in its purest state". Then there are, or rather would be, all the alloys with manganese as a major constituent. That the minor alloying constituents in such alloys need not all be too conventional is suggested by the recent claim that the properties of known manganese-copper-zinc alloys are improved by the introduction of nitrogen, the composition range being 5-30 per cent copper, 5-20 per cent zinc and 0·1-5 per cent (preferably 0·1-1·0 per cent) nitrogen, the remainder (preferably not less than 60 per cent) being manganese. In preparing the alloys by melting, nitrogen is introduced in the form of a nitrided electrolytic manganese containing 6 per cent nitrogen. A typical alloy composition would be 79·5 per cent electrolytic manganese, 10 per cent copper, 10 per cent zinc and 0·5 per cent nitrogen. It can be worked both hot and cold. The nitrogen-containing alloys have a higher tensile strength than alloys of similar copper and zinc content not containing nitrogen, while the ductility and corrosion resistance are as good as those of the known alloys.

Skimmer

RECENT DEVELOPMENTS FOR THE NON-FERROUS METAL INDUSTRY

Oil-Fired Furnaces

By J. A. TAYLOR, B.Sc.(Eng.), A.M.Inst.F.
(*Fuel Oil Dept., Shell-Mex and B.P. Ltd.*)

(*Continued from* METAL INDUSTRY, 3 *March* 1961

AT the instigation of the Technical Sub-Committee of the Joint Standing Committee on Safety, Health and Welfare Conditions in Non-Ferrous Foundries, work has been in progress to improve working conditions in non-ferrous foundries including investigation into the thermal environment of foundry personnel. As is well-known, in warm weather conditions these foundries can become very hot and unpleasant. This is not surprising when practice is such that for castings only a few pounds in weight, 200 lb. of metal may be held above its melting point in open crucibles, continuously imparting heat to the surrounding atmosphere. The early work was, therefore, directed towards obtaining factual indication of the actual thermal conditions which existed. Consequently, a survey of the conditions in 14 non-ferrous foundries was undertaken. This study,[3] taken to give a good cross-section of the industry, showed that, in certain cases conditions approached the limits of human endurance and indicated that whilst such palliatives as radiation shields and control of convection by the use of local exhaust ventilation systems certainly improved the thermal environment, they were expensive means of so doing.

The fundamental principle of the problem was that fuel should be used to melt metal, not wasted in making operatives uncomfortable. The work showed that certain furnaces operated at thermal efficiencies as low as 13·55 per cent, and steps were, therefore, taken to raise furnace efficiency progressively. Work has been undertaken to raise the efficiency of bale-out furnaces and this is described in the appropriate section of this article, but in the thermal environment studies it was decided to use a furnace of reverberatory design to melt 250 lb. of metal, which incorporated means of preheating the charge with flue gases. Tests indicated a thermal efficiency of 28·65 per cent. A further furnace of 600 lb. capacity was then built which, when tested, gave a thermal efficiency of 31·9 per cent, with 0·81 per cent metal loss (aluminium alloy). A similar furnace[4] of 400 lb. capacity incorporating insulating concrete and a self-proportioning burner, has been reported, after two and a half years with the original lining, to be melting 400 lb. of aluminium to 750°C. in 1½ to 2 hr. at 2 gal/hr. and to have "vastly improved working conditions".

This work showed that thermal environment could be improved by reducing waste heat losses and, so encouraged, a further furnace[5] was designed for higher thermal efficiencies. This furnace, of simple reverberatory construction, fitted with a bale-out pool, was found to work at a furnace efficiency of 44 per cent (152 lb. of aluminium per gallon of oil) when melting aluminium which was gas-free for all practical purposes; in addition, most of the outside surface of the furnace was cool enough to be touched.

This work in improving thermal environment is not yet complete and, whilst it has been possible to increase thermal efficiencies from 13·55 per cent to 45 per cent, this is not the limit. Publication of further work on this subject can be anticipated.

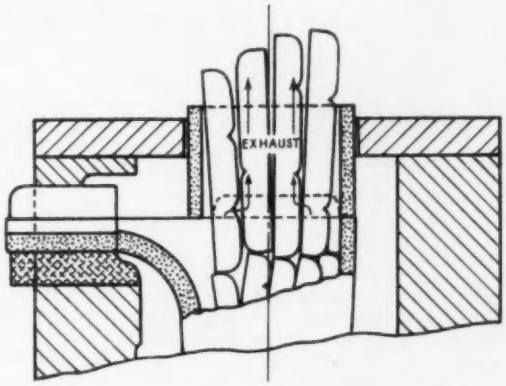


Fig. 9—Arrangement of crucible for supercharge pre-heating

[Courtesy Morgan Crucible Co. Ltd.

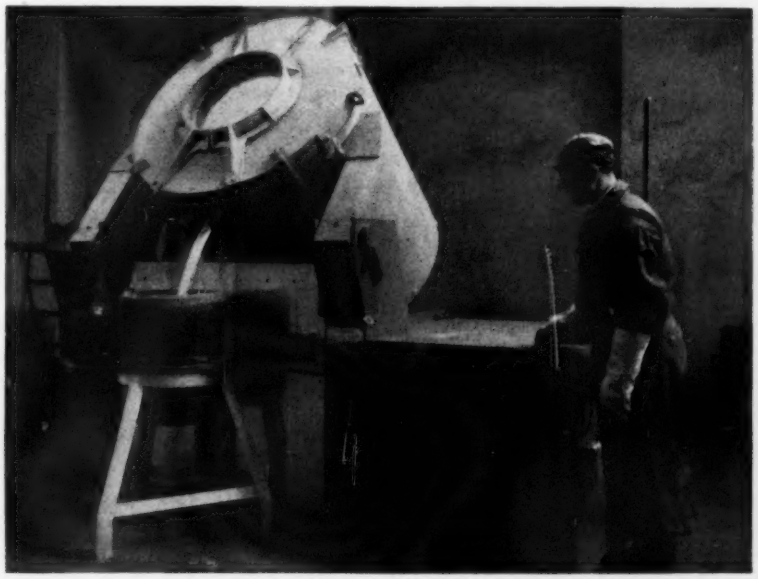
Crucible Furnaces

Foundrymen have long recognized the advantages of flexibility and ease of control of liquid fuels, particularly in operating crucible furnaces. Nevertheless, appreciable factors in the operating costs are metal loss and fuel consumption. Much work has, therefore, been carried out to reduce these.

Jackson and Brown[6] indicated that with good melting practice, but with no special precautions, the gross losses in melting leaded gunmetals ranged between 2 and 4 per cent of the melt

Fig. 10—Basin tilting furnace

[Courtesy Morgan Crucible Co. Ltd.



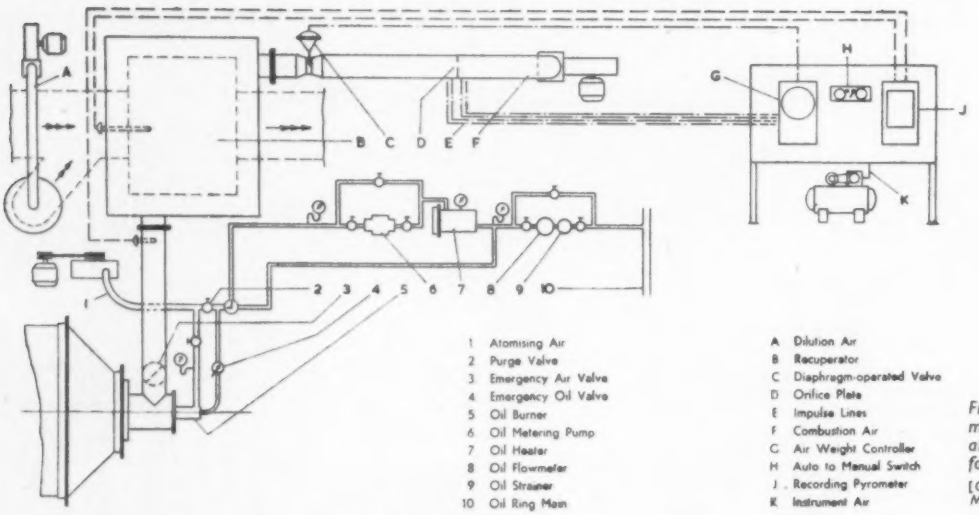


Fig. 11 — Diagrammatic arrangement of air/oil control system for rotary furnaces
[Courtesy Manometer Manufacturing Co. Ltd.

weight; with common and high tensile brasses the figure was about 2½ per cent and with phosphor bronze it was only ¼ per cent. It was shown that the use of charcoal covers was especially effective in reducing the loss of gunmetal to about ½ per cent, whilst flux covers substantially reduced the losses with high tensile brass.

For difficult alloys, where gas or sulphur pick-up must be avoided, the closed-crucible method is used, as with this the metal can be kept under reducing or oxidizing conditions as required, independent of the nature of the flame.

Where flame contact with the charge is allowed, supercharge preheating[7] improves thermal efficiency and provides more rapid melting. With this method (Fig. 9), slots are cut in the crucible or muffle ring above the level of the molten metal, thus allowing the flame to preheat the solid charge in the early stages of the melt. Allowing flame contact in this manner usually results in an improvement in melting time of about 20 per cent with a corresponding saving in fuel of at least 15 per cent. With this method, metal losses are not necessarily increased as the flame is only in contact with solid metal in the upper part of the crucible, where the temperature is comparatively low, and as the metal in the hot zone at the bottom of the crucible melts, the charge sinks down within the protection of the crucible walls. This method is suitable for use with most copper and aluminium alloys, especially when remelting ingot and large scrap when the gas content of the melt is not critical, or where efficient degassing methods are used. It is not recommended, however, for aluminium alloys or copper alloys containing more than 10 per cent of tin, lead or zinc.

A furnace designed to take full advantage of this technique is the Basin Tilter (Fig. 10). Not only has this resulted in faster melting, but it has made possible the use of a crucible which is appreciably cheaper. This crucible, being basin-shaped, has a smaller surface area and is therefore inherently less efficient than the conventional tilter pot, which is relatively tall. However, for most non-ferrous work this is completely swamped by the advantages of supercharge preheating. This basin shape has resulted in a furnace which is much squatter, greatly facilitating charging and the larger diameter of the basin permits the charging of bulky scrap.

Rotary Furnaces

With this type of furnace, fuel consumptions of 18 to 22 gal/ton when melting copper alloys and bronze alloys are obtainable. With aluminium alloys, figures of 12 to 14 gal/ton are typical.

It does not, however, permit combustion control by flue gas analysis, as that part of the furnace which is not occupied by metal is filled with flame. Operators are largely guided, therefore, by observation of the flame.

A system of control which has been specially developed for this type of furnace is shown diagrammatically in Fig. 11.

The oil and air are individually metered, the oil by means of a positive displacement metering pump and the air by an arrangement which allows for deviation of pressure and temperature from standard conditions. Thus, precise control for any required air/oil ratio is achieved, allowing for changes of air density.

Referring to the diagram, the air supply is maintained at a pre-set value by means of a flow controller in which a device for compensating for pressure and temperature variations is incorporated. The volume of the air passing to the burner is measured by an orifice plate on the delivery side of the fan, the differential pressure across the plate being transmitted to the flow controller. An air bleed to the compensating device is also provided. The controller operates a diaphragm valve in the air line, keeping the air supply to the burner at whatever pre-set quantity is required. This arrangement meters the air before passing through the recuperator, which must not, therefore, allow any leakage to occur in the air passages. It does not meter the small quantity of air which is used for atomizing the fuel, but, as a medium pressure air burner is used, this is only

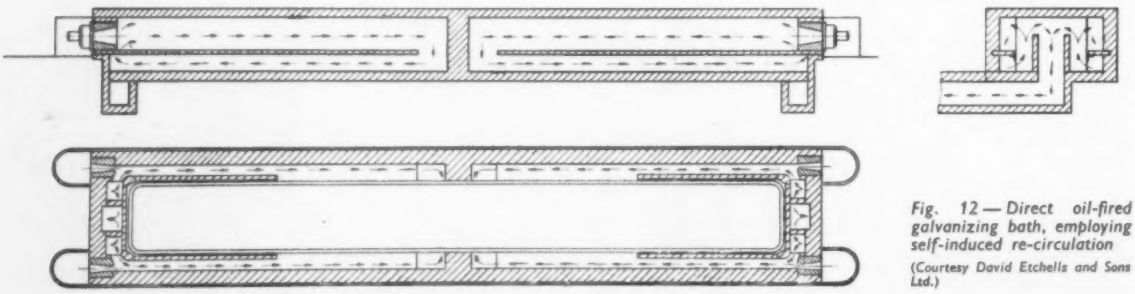


Fig. 12 — Direct oil-fired galvanizing bath, employing self-induced re-circulation
(Courtesy David Etchells and Sons Ltd.)

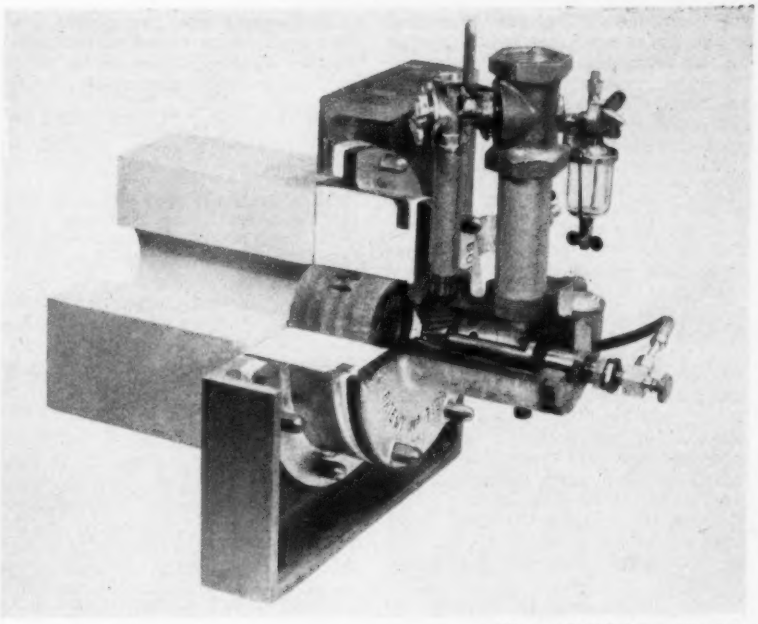
some 2 to 3 per cent of total air requirement and can be allowed for when determining the quantity of air that is to be metered at the orifice plate.

Galvanizing

A recent survey of the types of oil-fired galvanizing baths available was presented to the 5th International Conference on Hot Dip Galvanizing held in Holland and Belgium in June 1958.[8]

The temperature of molten zinc is 450°C. to 455°C., and it is important in galvanizing bath design to avoid temperatures greatly in excess of this, as above 480°C. the zinc rapidly attacks the steel bath. An oil flame, particularly that from residual fuel, can produce a high temperature, highly radiant flame, and whilst for high temperature work these are highly desirable characteristics, for relatively low temperature work means of reducing the rate of heat transfer from the flame to the pot is necessary if overheating the bath, with consequent short life, is to be avoided.

Early designs of oil-fired galvanizing baths used protective brickwork adjacent to that part of the bath where excessive rates of heat transfer would otherwise occur, the type of brick used



[Courtesy David Etchells and Sons Ltd.

Fig. 13—High intensity oil burner

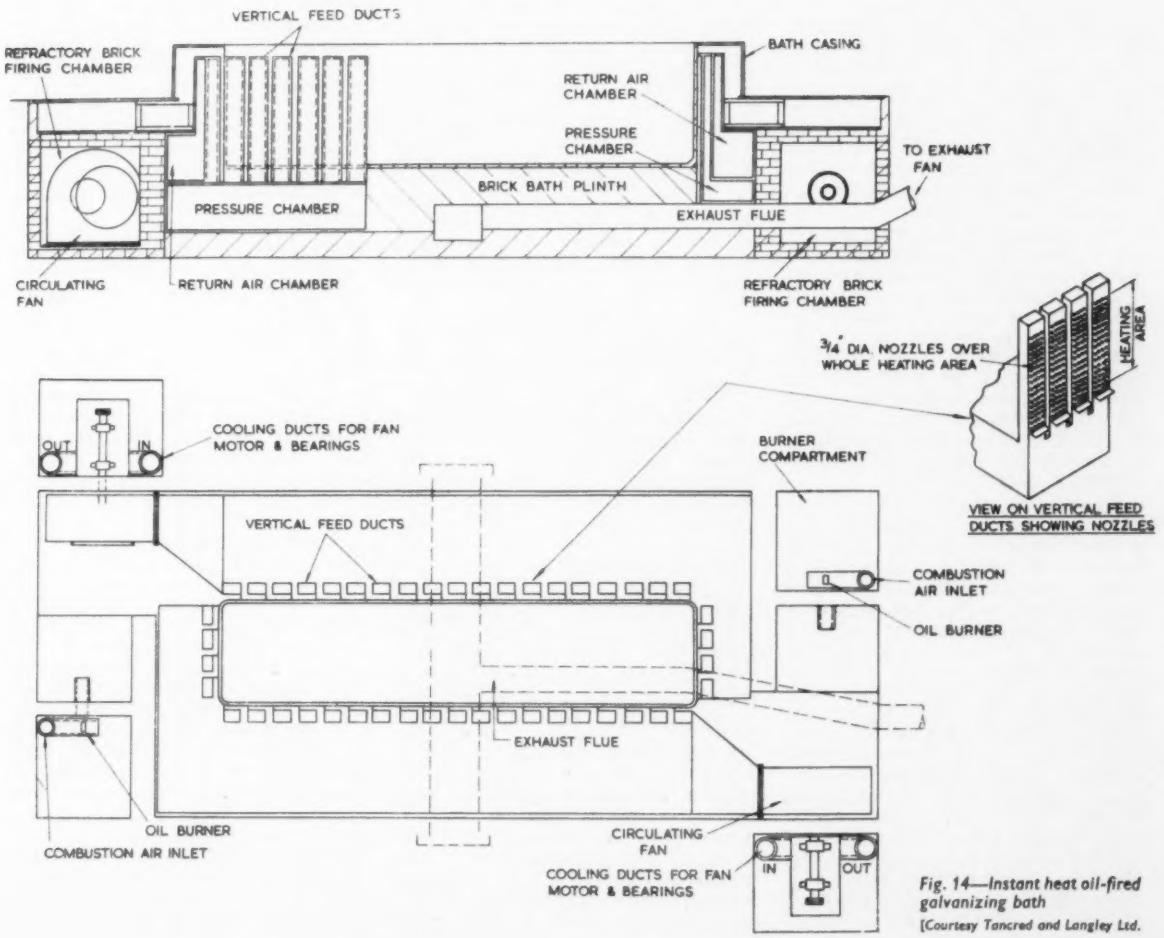


Fig. 14—Instant heat oil-fired galvanizing bath

[Courtesy Tancred and Langley Ltd.

and its thickness being varied according to the gas temperature. This design has its limitations as it is, to a great extent, a matter of compromise of refractory thickness, etc. Overheating still tends to occur, particularly in the region where the flame is present.

Partially protected baths incorporating an air space between the refractory protective wall and the bath are also available, the flame being shielded from the bath by the wall, which itself radiates some heat to the bath. Additional heating of the bath is obtained by passing the products of combustion through the air space.

A more recent approach to the problem has been to burn the fuel in a combustion chamber outside the bath setting and circulate around the bath products of combustion at such temperatures that bath protection is minimized (in some cases eliminated) and overheating does not occur. This involves recirculating the waste gases from the setting to dilute the products of combustion from the combustion chamber.

Recirculation can be "forced" by having an adequately sized fan to handle the requisite volume of gases to obtain the required rates of heat transfer, or "self-induced" by employing high intensity burners.

An example of the latter is shown in Fig. 12, in which four high intensity burners are used, the necessary recirculation being obtained by the high velocity gases issuing from the burners. With this type of burner (Fig. 13), combustion is virtually completed within the burner itself, making external combustion chambers unnecessary.

A particularly interesting application of forced recirculation is the "Instant-heat" system. In this method, the duct work is so arranged that hot gases pass at high velocity through a series of nozzles spaced around the bath. The gas leaving the nozzles impinges at right angles to the bath wall. In this way, the heat transfer is increased by wiping away the stagnant boundary layer. Indicative of this is that the maximum gas temperature required for a metal temperature of 450°-460°C. is 600°C.

A typical installation is shown in Fig. 14. Two "L" shaped plenum pressure chambers are arranged to surround the walls of the bath, each chamber being connected to the outlet of a centrifugal fan, the fans being situated at diagonally opposite corners of the setting. Vertical feed ducts containing the nozzles are connected to the plenum chambers, a vertical space being provided between individual ducts through which the gases are withdrawn after passing through the nozzles and impinging on the bath walls. After passing through these vertical spaces, the gases enter a return duct and are drawn to the fan diagonally opposite to that from which they were blown. At this point, they meet fresh products of combustion leaving the combustion chamber, the mixture, after an appropriate quantity has been spilled from the system, being passed to the second plenum chamber. This system lends itself to accurate temperature control as the setting has little stored heat and extended bath life can be expected because of the even heating obtained from the relatively low temperature gas.

References

[5] D. Turner, W. Lawrie, A. Eyden and A. Edwards; *Met. Ind.*, 1956, **88**, 393, 413.

[4] G. A. Hodges; *Foundry Trade J.*, 1959, November 12.

[5] E. Ayres and W. B. Lawrie; *Foundry Trade J.*, 1960, August 18.

[6] R. S. Jackson and D. W. Brown; *British Foundryman*, 1957, March.

[7] D. W. Brown; *Foundry Trade J.*, 1957, January 24.

[8] J. G. C. Pope; "Oil-Fired Galvanizing Baths", Proceedings of the Fifth International Conference on Hot Dip Galvanizing, Zinc Development Association.

(To be concluded)

Men and Metals

It has been announced by Ferro Enamels Limited that **Mr. G. Vickers,** A.M.I.E.E., A.M.I.Mech.E., has been appointed their general sales manager. Mr. Vickers was apprenticed to The General Electric Company Limited, Witton, and then became chief engineer to a group of companies engaged in steel and non-ferrous metal processing. He subsequently served in the administration of German industries in the Ruhr, before joining The British Aluminium Company Limited, and later was appointed chief executive officer of a manufacturer of holloware and associated products in the Midlands. Mr. Vickers is director of the Vitreous Enamel Development Council and vice-chairman of the Hardware Manufacturers' Association.

As part of the policy of The Ruberoid Company Limited, of building up their development department, **Dr. H. A. F. L. Kremer,** B.Sc., Ph.D., has been appointed to fill the newly-created position of chief development chemist. **Mr. D. S. Symons,** A.M.I.Mech.E., has joined the company as chief maintenance engineer at their Brimsdown factory, and **Mr. Mr. C. W. High** is appointed electrical engineer.

Appointed to the board of Lancashire Dynamo Electronic Products (Metal Industries Group), **Mr. K. A. Robinson** joined the company as chief development engineer in 1948. In 1959 he was appointed chief engineer and lately he has assumed responsibility for marketing.

Appointed by the Delta Metal Company Limited as assistant managing director, **Mr. A. F. Thomas,** F.C.A., first joined the company in 1953. On Monday last, Mr. Thomas started a ten-day visit to Delta's associated companies in South Africa.

Responsible for sales in the United Kingdom and Western European markets, **Mr. Harry Brook** has been appointed sales manager to the L.S. Starrett Company Limited, the Scottish precision tool firm and the newly-formed subsidiary of the Massachusetts firm of precision tool and saw manufacturers.

Promoted to the new position of assistant export manager of Acheson Colloids Limited, **Mr. K. Clark** joined the Acheson organization seven years ago. His new appointment is the first step in an expansion programme designed to increase overseas outlets for the "dag" range of dispersions.

New sales appointments announced by CIBA (A.R.L.) Limited are as follows:—**Mr. D. A. Leitch** to be Southern area manager; **Mr. L. W. Taylor** to be Scottish area manager; and **Mr. J. M. Turner** to be Midlands area manager. **Mr. S. Hopwood** continues as Northern area manager, and **Mr. G. Grant** as North Midlands area manager.

It is announced that **Mr. Eric Hindson** and **Dr. H. E. Zentler Gordon** have been appointed directors of Welding Improvements Limited. **Dr. G. M. Blanc,** of Zurich, will act in a consultative capacity.

Tin-Alloy Bearings

HELD last week in Paris, the 10th Journée de l'Etain had as its general theme "Tin-Base Bearings", with particular reference to the manufacture of tin-base bearings for larger engineering units. The chairman was Professeur P. Bastien, Director of Research and Professor at l'Ecole Centrale des Arts et Manufactures.

Four Papers were presented: "The Choice of a Bearing Metal", by Mr. W. R. Lewis, assistant director of the Tin Research Institute; "The Effect of Preparation and Tinning Procedures on the Adhesion of White Metal Linings to Steel and Cast Iron", by Dr. W. E. Hoare, assistant director of the Tin Research Institute; "The Tinning of Large Bearing Shells in Steel and Cast Iron, and the Application of the Direct Chloride Process at Société des Forges et Ateliers du Creusot", by Monsieur M. G. Charnet, of Société des Forges et Ateliers du Creusot; "The Use of White Metal Bearings in Engineering Construction and Maintenance", by Monsieur J. Bertrandias, of Ets. Bertrandias, Paris.

Atomic Progress

Corrosion of Austenitic Stainless Steel in CO_2

STAINLESS steel is of interest as a cladding material for nuclear fuel elements containing uranium dioxide and for fuel elements of the mixed fuel-moderator type. These fuel elements are intended for use in gas-cooled reactors in which CO_2 is to be the coolant. Several basic reports on the oxidation of stainless steel have been published over the last 10 years, but these are of little direct value in assessing the potentialities of austenitic steels in CO_2 at the required reactor temperatures in the range 550°-750°C. Draycott and Smith[1] presented a detailed Paper on this subject to the International Atomic Energy Agency Symposium on Fuel Elements, held in Vienna in May 1960. Their results are of considerable interest, and are reviewed in this article.

In this work, the steel was nominally an 18/8/1 Ti stabilized steel of per cent composition: 18·2 Cr, 10·5 Ni, 0·12 C, 0·08 Si, 0·027 P, 0·38 Ti, 0·72 Mo, 1·22 Mn. CO_2 produced by a fermentation process was used, in which the main impurities were 200 p.p.m. oxygen and 800 p.p.m. nitrogen; moisture was usually below 50 p.p.m. The main variables studied were the effect of temperature, pressure, gas velocity, and surface preparation.

Results

Surface condition was found to have a very pronounced effect. The basic surface conditions were "as-received" or "ground"; these surfaces were tested as such and also after etching or vapour blasting. The etched surfaces showed weight gains more than ten times greater than those from vapour-blasted specimens, with "ground" or "as-received" specimens giving intermediate results. Two distinct types of oxide scale were observed:—

(1) On vapour-blasted specimens, X-ray diffraction revealed Cr_2O_3, Fe_2O_3 and a spinel of high lattice parameter in the 1-2 micron thick film. It was thought from the film structure that most of the oxide layer was Cr_2O_3, with local regions of Fe_2O_3 and intrusions of up to 10 microns of the spinel. This type of scale is favoured by high chromium contents and low oxidation temperatures.

(2) On mechanically polished and etched specimens there was a 20 micron thick scale with three distinct layers, with some flaking of the outer two layers. X-ray diffraction revealed only two structures: a structure close to Fe_2O_3 and a cubic spinel structure close to Fe_3O_4. Draycott and Smith believe the outer layer to be Fe_2O_3, the middle layer to be Fe_3O_4 and the inner layer to be a mixed Fe-Cr-Ni spinel. This type of scale is found on lower chromium steels, especially at higher oxidation temperatures.

Draycott and Smith interpret the differences in oxidation rates and oxide scales as due to differences in the work-hardening of the surfaces.

Vapour blasted "as-received" specimens commonly exhibited "warts" in the scale. These were localized regions of the second type of scale, where there was marked inward or outward growth of the scale.

The effects of temperature and pressure were studied on material with vapour blasted surfaces. Weight gains could be expressed by the equation

$$\triangle W = kt^n$$

where

$\triangle W$ is the weight gain in mgm/m^2
k is the rate constant
t is the time in hr.
n varied between 0·2 and 0·6.

At low pressures, the rate law was approximately cubic, and at 225 lb/in^2 approximately parabolic. The effect of pressure on oxidation rates was complex. At 575°C. the oxidation rate was proportional to $p^{\frac{1}{2}}$, at 650°C. proportional to p, and at higher temperatures proportional to a power of p greater than 1. Draycott and Smith found that the weight gains could be expressed as a function of pressure, temperature and time by the following equation

$$\triangle W = c\, e^{Dp.1\cdot5}$$

where

p = pressure in lb/in^2 absolute.
D = constant

$$= 2\cdot303 \times 10^{-4} \frac{\text{mgm}}{\text{cm}^2} \times \left(\frac{\text{in}^2}{\text{lb.}}\right)^{1\cdot5}$$

c = a constant depending on temperature and time, values of which are given by Draycott and Smith.

Gas velocity effects were not completely examined and tests were limited to 100 hr. duration at 650°C. and slightly above atmospheric pressure. Gas velocities of 10-83 ft/sec. were employed. Compared with the semi-static tests, weight gains were increased at the faster velocities by a factor of 20.

CO_2 saturated with moisture (23,000 p.p.m.) gave about 1·3 times more weight gain than dry gas (250 p.p.m. H_2O) in tests at 1 atmosphere pressure. This result suggests that complicated drying processes would not be required in a reactor coolant circuit, provided the moisture did not adversely affect other materials in the reactor. However, a firm recommendation on this would require to be supported by tests at reactor pressures.

Removal of chromium from the zone immediately below the oxide layer led to the formation of a second austenite phase having a lattice parameter 0·14 per cent less than that of the parent austenite.

Discussion

The oxidation resistance of stainless steel is recognized to be primarily the result of selective oxidation of the chromium to give a protective film of Cr_2O_3. Selective oxidation of Si to form SiO_2, and the formation of the spinel $FeCr_2O_4$ may also play a part. These films are metastable and eventually must break down to less protective but more stable phases. At higher temperatures a scale forms consisting of a Fe-Cr-Ni spinel, Fe_3O_4 and Fe_2O_3 which may or may not be preceded by the formation of a protective film of Cr_2O_3. Thermodynamic considerations indicate that oxidation in CO_2 should lead to the formation of similar equilibrium phases as for oxidation in air. Similar oxidation rates would also be expected unless there is a change in nucleation characteristics.

The marked improvement in oxidation rates of vapour-blasted surfaces is attributed to enhanced diffusion rates of chromium in the work-hardened surface layers and to preferential nucleation of Cr_2O_3. The effects of pressure and gas velocity are thought to be due to less favourable conditions for the nucleation of Cr_2O_3. Draycott and Smith suggest pre-treatment at low temperatures to form the protective Cr_2O_3 film may reduce oxidation.

On the basis of about 2·0 per cent loss in thickness due to oxidation, Draycott and Smith consider 18/8/1 steel suitable for fuel cladding in a CO_2 coolant at 225 lb/in^2 gauge and with a velocity of about 100 ft/sec. for 10,000 hr. at 675°C. This temperature is probably rather too low for advanced gas-cooled reactors, and coupled with the tendency for the material to spall under certain conditions, points to the need for examination of other cladding materials, such as austenitic stainless steels with higher chromium and nickel contents, with improved oxidation resistance.

References

[1] A. Draycott and R. Smith; Symposium on Fuel Element Fabrication, Vienna, May 1960. F.E./1/IV.3.

Aluminium Rolling Stock

OBTAINABLE from the Aluminium Development Association, the Proceedings of last year's "Symposium on the Use of Aluminium in Railway Rolling Stock" have just been published. Five Papers deal with "Design and Construction" and eight with "Operation and Service Experience". The price is 42s.

Products and Processes

TRENDS IN THE DEVELOPMENT, APPLICATION, PROCESSING, DESIGN AND WORKING OF NON-FERROUS METALS AND THEIR PRODUCTS

Rubber Press Technique for Economical Forming

FOR the production of a wide range of metal pressings ranging from table ware to motor car components, Boulton Paul Aircraft Ltd., of Wolverhampton, have developed and are now operating their own Suproform hydraulic rubber press. In this press the sheet material to be deformed is interposed between a shaping die and one face of an elastic diaphragm and fluid pressure is exerted on the other face of the diaphragm to press the sheet material against the shaping die. The hydraulic fluid pressure is applied in two stages in that the elastic diaphragm is subjected to an intensified hydraulic pressure after the completion of a hydraulic pressure stage.

Owing to the economy of this production technique, decorative metal panels with a high degree of definition for individual buildings now become an economical proposition. This applies even to a small single panel carrying an ornamental motif or insignia.

One of the most important advantages is that the surface of the pressing is free from any blemish. A second consideration is that the reaction to the variable pressing load, ranging up to 5,000 lb/in^2, is transmitted entirely through the locking means holding the fluid pressure chamber and the rigid closure or platen together, so that the heavy hydraulic rams and supporting pillars and frames used in conventional presses are unnecessary.

Trimming and Scurfing

DESIGNED to cut, smooth, shape and trim hard materials—mild steel, aluminium, copper, brass, etc.—an "Industrial Tool" has been developed by Firth Cleveland Tools Limited, manufacturers of Surform hand tools and power tool accessories. Its working surface consists of a perforated "blue blade" of hardened and tempered Sheffield tool steel specifically designed for industry, and, although similar in principle to the well-known Surform blade, it has certain design features which make it suitable for an entirely different range of applications. One of the features of this tool is its ability to trim corners of hard materials without chattering or damage to the blade.

Induction Heating for Soldering Type-Pieces

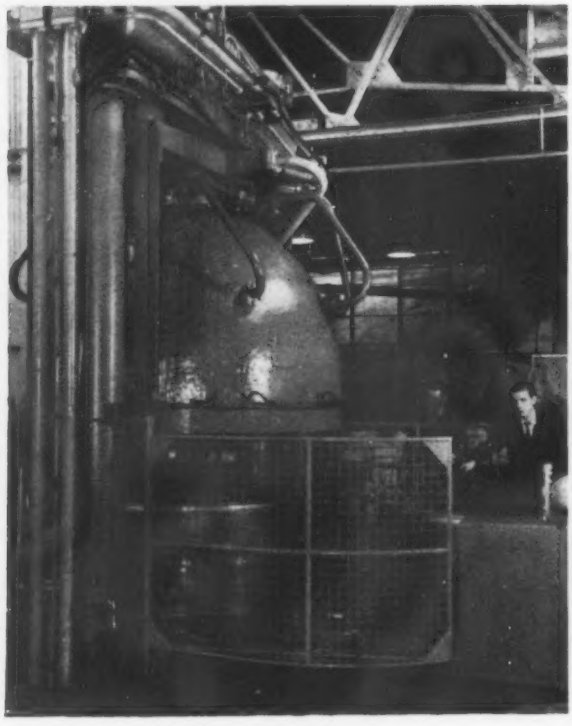
IN a new method of attaching type-pieces to type-bars of typewriters, teleprinters, accounting machines, and allied products, 1 kW induction heaters are being used. The manufacturers of the equipment are T.S. Precision Engineering Ltd., and it enables type-pieces to be fixed with the minimum possibility of error, at more than twice the speed of conventional methods. There are also many advantages to be gained by the use of the induction heating process over conventional methods of type soldering. The induction heater is the Redifon Type IH.64.

The equipment permits accurate alignment of the type-pieces to the type-bar, and a means of selecting the correct type-piece for attachment without constant checking. Set up ready for soldering typewriter segments, it comprises the induction heater, a pneumatically-operated magazine for holding the type prior to soldering, and a type segment assembly.

Each type-piece is filled automatically with special resin-cored solder in a separate machine, also developed by T.S. Precision Engineering. Patent applications have been filed for both equipments.

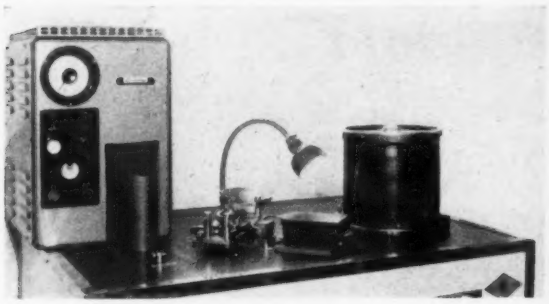
Rapid Automatic Hydraulic Clamping

AUTOMATIC hydraulic clamping is provided by the Newton swing clamp which, as its name implies, has a swinging arm action. It is small, powerful and fast, and may be used singly or in series. In the "off" position, the clamping arm is lying at right angles to the work, giving ample room for positioning and unloading. At the touch of

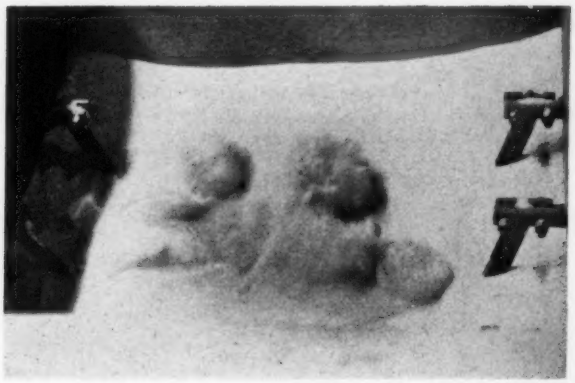


Left—The Boulton Paul "Suproform" hydraulic rubber press

Below—Fettling non-ferrous castings with the Firth Cleveland "Industrial Tool"



Above—T.S.P. type-soldering fixture and equipment



Right—Fluidized bed heat-treatment bath

a lever, the arm swings in over the work and is tilted by a hydraulic plunger to apply pressure. The combined movement is completely automatic. When released the arm swings back to the start position.

Installation is simple, and the small size of the clamp (7 in. by 3½ in. with a maximum clamping force of 1,160 lb.) is a great advantage where space is limited. No maintenance is required and the application to clamping problems is universal.

The Newton swing clamp is a product of Power Jacks Ltd.

Fluidized Bed Heat-Treatment

IN arrangement resembling a standard molten salt bath with customary temperature control and recording equipment, the fluidized bed heat-treatment furnace introduced by General Electric (U.S.A.) is based on the first successful commercial application of what, in itself, is a much older conception. Heat is transferred from electrical heating elements at the bottom of the fluidized bed to the workpieces suspended in the bath through the turbulent circulation of heated ceramic particles induced by passage of the fluidizing gas stream. A variety of furnaces can be provided for batch or continuous operations, capable of covering a wide range of working temperatures, as desired.

Advantages of the furnace lie mainly in improved heat transfer to the workpiece, so that heat-treatment times are much shorter than those for similar workpieces submitted to salt bath heating. Reductions in time to attain working temperature of up to 85 per cent are claimed.

This is explained by the fact that, in the fluidized bed, a hot particle makes contact with the workpiece, gives up its heat and is swept away by the following stream of hot particles. In salt bath heating, the first thing that happens when a cold mass of metal is immersed in the bath is that an envelope of solid salt freezes out on to, and thermally insulates, the workpiece until its surface temperature rises at least to the freezing point of the salt mixture.

Another advantage is that blow back of molten salt from air pockets or oil or moisture on the workpiece is eliminated. In addition, the work is not wetted, cannot stain and needs no post-heat-treatment cleansing.

Forming Aluminium Foil

FOR the production of aluminium foil cups and trays, a horizontal foil press, designed and manufactured by H. and T. Mellor Ltd., incorporates photo-electronic controls designed and made for use with the press by Hird-Brown Limited.

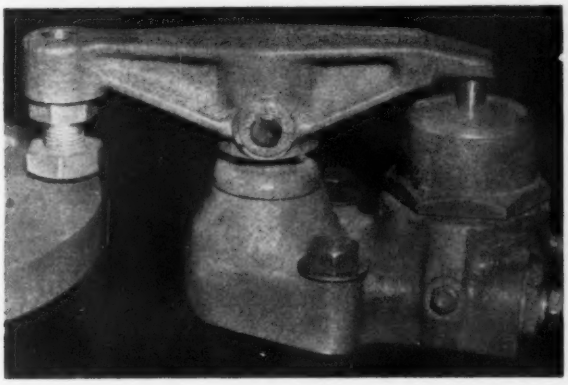
The Mellor press, which will accept aluminium foil rolls of up to 16 in. wide with an adjustable through feed of up to 10 in., will operate at 50, 75 or 100 strokes/min. Alternatively, a variable speed drive can be fitted. The die-plate has been so designed that several aluminium foil cups can be pressed at one time. These fall into a space below the machine, where they can be either stacked or carried away on a conveyor.

The electrical equipment supplied by Hird-Brown Ltd. includes three coloured warning lights. The red light indicates motor overload; the blue, broken or bent foil; and the yellow, end of predetermined count.

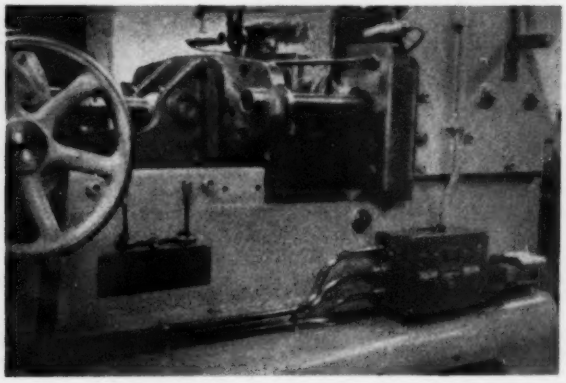
A complete photo-electronic control unit ensures that, should the foil break or bend, the machine will stop immediately and the blue light will signal to the operator. Another safety device is a micro-switch, located behind the fixed die plate, which will stop the press if a foil cup fails to eject from the die set.

The press is intended for semi-automatic operation so that after a new foil has been fed into the machine the operator can start it up and leave it until a pre-set number of strokes have been made. The machine will then stop and the yellow light will signal to the operator.

The Newton swing clamp in operation



Close-up of a Mellor horizontal foil press



Organic and Metallic Finishes

By R. J. BROWN, A.I.Mech.E., F.I.M.

(*Chief Materials Engineer, British Motor Corporation*)

(*Continued from* METAL INDUSTRY, 3 *March* 1961)

FLEXIBILITY is a most important property of an organic coating and has, undoubtedly, a very close relationship with that of service performance. The majority of assemblies finished with organic coatings are subject to some degree of flexing in service, and, in some instances, to considerable deformation in the production stages, as in metal rectification in motor body construction. A flexible coating will accommodate the stresses imposed, whereas a non-flexible coating will crack and may even peel if its adhesion is poor. Tests for assessment of flexibility must obviously be based upon deformation of the film in some way, such that an extension is produced. These assessments normally depend upon either a simple bend test, as in D.T.D.517A, or a conical bend test in which the measurement of comparative flexibility is the smallest radius of bend which the coating will withstand without cracking when applied over a standard basis material, for which purpose tinplate is normally used. The Erichsen and Olsen cupping tests for adhesion also provide some measure of flexibility, but the true flexibility can only be determined on the unsupported film, a procedure which is outside the scope of this article, although the properties of unsupported films are, of course, regularly determined in the research laboratories of paint manufacturers.

Chip Resistance — This is a most important property and one for which no satisfactory standard test has yet been devised. One form of test involves the impingement of gravel or sand of a defined size against the surface of the test specimen, the apparatus being generally referred to as a Gravelometer. In some forms, this test may produce effects which result from flying stones, whereas in other forms it is more specifically an abrasion test.

Chip resistance would appear to depend upon the co-related influences of such properties as adhesion, hardness, elasticity and ductility, and is related particularly to the vulnerable areas such as the edges of doors, which most of us know from experience get damaged, due to their unwitting contact with a garage wall. In some instances, considerable damage can occur even before the finished product leaves the factory, due to carelessness on the part of fitters and trimmers, who have a tendency to carry out their work with heavy tools protruding from their pockets. An instrument which appears to have some promise is being used in the U.S.A. and comprises a spring-loaded punch (Fig. 7), the punch being provided with a spring and calibrated plunger, chip resistance being defined as the loading at which chipping occurs; the advantage of such a test is that it could be modified for testing to quite a small location on the surface of the finished product, whereas the Gravelometer type of test can only be applied to the main body of the component or to a test panel.

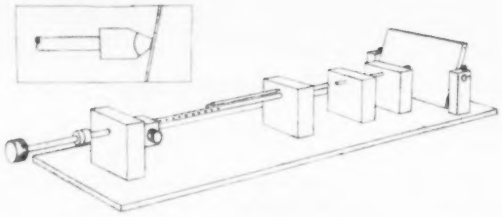


Fig. 7—Apparatus for testing chip resistance. The striking head is shown enlarged in the inset

Resistance to Staining—In the course of normal service, contamination of the surface of the finish by a variety of materials may occur, and it is possible in some instances for an inter-action between a contaminant and the organic coating to occur, resulting either in early and visible gross discoloration, or a more subtle change in shade with pastel colours on prolonged exposure to daylight. Staining which occurs without the necessity for exposure to sunlight is referred to as contact staining, and that which involves photo-sensitivity, as migration staining. Contaminating materials which give rise to most troubles are petrol, grease, tar, brake fluid and rubber, and the staining effect is caused by some ingredient in the contaminants, which cannot always be identified, although with petrol and rubber, certain anti-oxidants are known to be the cause of staining. Of the organic finishes used by the motor industry, the stoving enamels are reasonably resistant to this particular trouble, but cellulose lacquers and modified cellulose finishes have, in the past, given much more trouble, and numerous tests have been employed, differing only in detail, but following the same general outline, to test either resistance of the finish to staining, or the staining characteristics of the contaminants. These tests involve the intentional contamination of the test panel with the suspect material, either by spotting on, or partial immersion in the case of fluids, followed by a heating cycle, usually of 1 hr. duration at a temperature between 40° and 60°C., with subsequent exposure to a high intensity ultra-violet lamp for a period of 15 to 60 min. (or to one cycle of the B.M.C. weatherometer, which will be described later). Staining tests, when rubber is involved, are carried out by holding the rubber in close contact with the paint during the heating cycle already referred to, followed by exposure of the panel to ultra-violet light.

Water Spotting—Resistance to water spotting, which may be due to leaching effects or to local chemical effects, should the water involved be heavily contaminated in any way, is checked by spotting water on to the surface of the test panel or by partial immersion, followed by drying off under a high intensity ultra-violet lamp to simulate the effect of drying in sunshine after a shower; a succession of such evaporations is carried out. Water spotting may result in the production of areas which are lighter in colour than the original finish, or in some instances darker in colour, the latter effect being, fortunately, quite rare.

Corrosion Resistance — To some extent this property is dependent upon the pre-treatment applied to the metal surface as well as to the intrinsic properties of the paint film: thus, an excellent and highly protective paint may well perform badly if pre-treatment is poor, and vice versa. Pre-treatment is not part of our subject, but the main requirement is absolute cleanliness, as the presence of contaminating matter will trigger off under-film corrosion in a very short time (Fig. 8). It is surprising how very much more effective is the pre-treatment, which may only be normal preparation without phosphate processing, applied to car bodies in the production shop as compared with pre-treatment of test panels prepared at times in the laboratory.

Corrosion protection requirements include the ability of the coating to prevent rust spread along the paint-substrate interface, as few assemblies go into service without some slight damage occurring in production or in transit. The basis of any accelerated test is that the results obtained shall be reasonably related to performance in the field, and for the property of

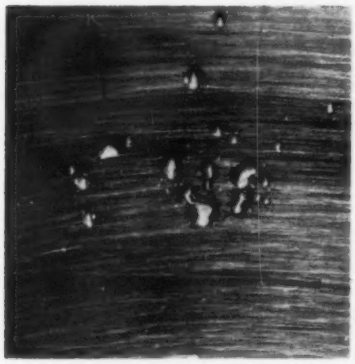


Fig. 8—Under-film corrosion arising from contaminated metal surface

Fig. 9—"Snail trails"; pattern of blisters following a water trail

Fig. 10—Small blisters denoting low resistance of coating system

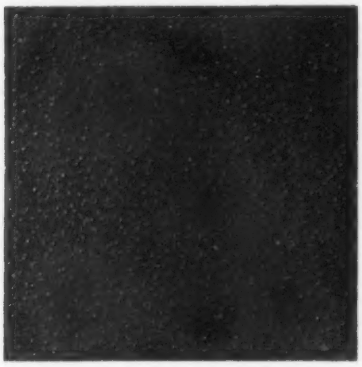
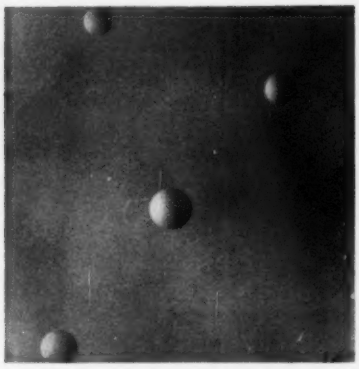


Fig. 11—Large blisters caused by high humidity encountered in shipping



corrosion resistance the ARE test as described in B.S.1391 has been generally adopted. This also specifies the type of damage which shall be applied to the test panel, i.e. the penetration of the paint film by means of two parallel lines scratched through to the substrate, and impact damage applied by the impact adhesion test device referred to earlier.

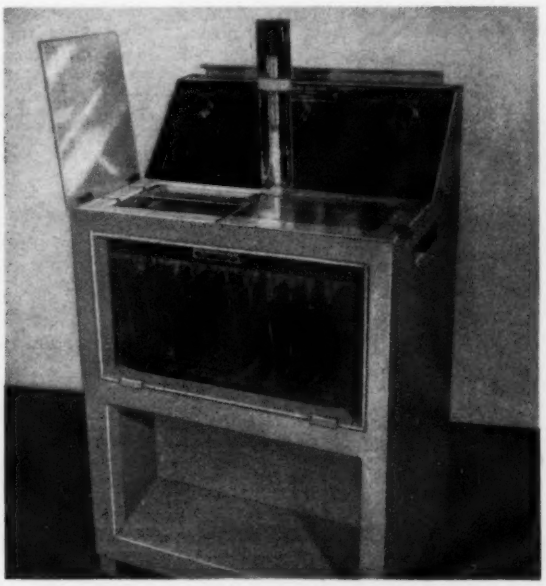
This particular corrosion test, in which the surface of the specimen is periodically contaminated with salt spray droplets, and then exposed under conditions of high relative humidity, is preferred to the continual salt spray test usually applied to the testing of electrodeposits. Corrosion resistance of an organic coating is a function not only of the coating material but also of coating thickness for a given coating material, and in the preparation of test panels this fact must be taken into consideration.

Blister Resistance—This property, as with so many other properties of paint films, results from the combined effects of the fundamental characteristics of the paint system; these are inter-coat adhesion, dimensional changes which occur in the paint films under fluctuating conditions of humidity and temperature, and of inter-coat cleanliness. The most common form of blistering occurring in service results from contamination, the cause being generally obvious owing to the fact that the blisters follow a distinct pattern, such as the outline of a water trail (snail trail, Fig. 9), or are quite localized. Low blister resistance of the system as a whole is usually denoted by general blistering, normally in the form of blisters of small size (Fig. 10), although under extremely adverse conditions of high humidity such as occur in inadequately ventilated ships cargo spaces, the blisters may be of quite large size (Fig. 11).

Some of the conditions which are known to foster blistering having already been established, it is obvious that any blister test will incorporate these conditions, which comprise both heat and moisture. Numerous pieces of apparatus have been built for this purpose,

Fig. 12—CCI cabinet for heat and water test

Fig. 13—Water immersion test cabinet



possibly the best known being the CCI test described in DEF.1053-9052 method number 25, which comprises a water bath cabinet in conjunction with cycling conditions of temperature (Fig. 12), but it suffers from the disadvantage that condensation effects on the surface of the panels are extremely severe and the results are not always in line with those which are found in service.

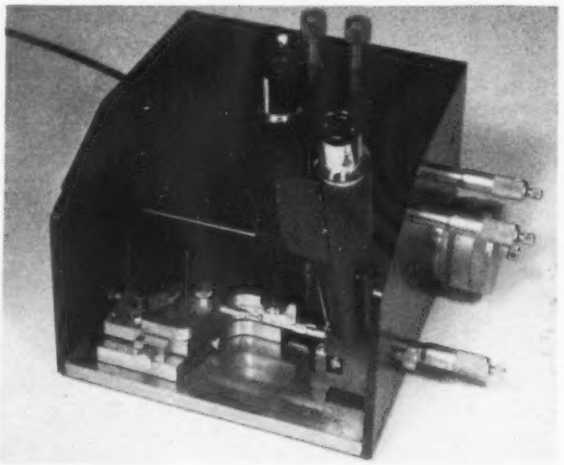
Other tests have employed the use of a water bath humidity cabinet with constant temperature, or a humidity cabinet of the Gallenkamp type, using cycling conditions. In an effort to overcome the disadvantages of these types of apparatus, a water immersion test is more generally employed (Fig. 13), even though there is considerable lack of agreement as to the temperature at which the test should be carried out and the time which the test panels can be expected to withstand blistering; in such a test, precise control of temperature is essential, and means must be provided for agitation, and such a test has been previously described.[4] In this particular apparatus, the test temperature is 100° ±2°F. and agitation is achieved by oscillation of the frame carrying the test panels.

Reference

[4] A. J. Birch; *Prod. Fin.*, 1956, May

(To be continued)

Micro-Tensile Testing



Micro-tensile testing machine devised by Techne (Cambridge) Ltd.

A MICRO-TENSILE testing machine has been developed by Techne (Cambridge) Limited, Duxford, Cambridge, to perform complete tensile tests on microscopic specimens. It was designed to test single crystal whiskers, which are often too small to resolve with the naked eye, but is suitable for any small specimens of similar dimensions.

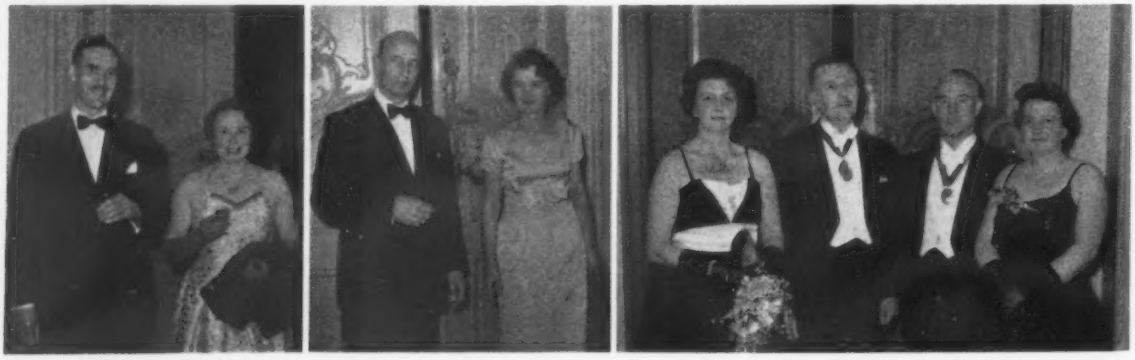
It employs a torsion balance to apply loads between 1 mg. and 400 gm. to specimens having lengths down to 0·5 mm. and cross-sectional areas between 10^{-2} and 10^{-7} mm^2 (20 millionths of in^2 to 1/5,000 millionth of in^2). Extensions from a few Ångström units to 15 mm. are detected by an auto-collimating telescope/mirror system and are measured by a sensitive micrometer acting through a simple lever train. In normal tests, extension measurements to the nearest 100Å are adequate, but in certain circumstances readings have proved repeatable to a standard deviation of less than 5Å (1/50 millionth of an inch). The stability required to measure such quantities is achieved by the extensive use of carefully designed flexure pivots.

The machine is wholly self-contained in a small box, which can stand on any table and is inherently drift-free as it is wholly mechanical and optical in design. It may readily be adapted for tests in compression, for tests in special atmospheres and for thin film testing.

Institute of Metal Finishing Midland Branch Dinner-Dance

SOME 400 members and guests attended the annual dinner and dance organized by the Midland Branch of the Institute of Metal Finishing at the Grand Hotel, Birmingham, on February 24. One of the features of the evening was an ingenious racecourse unit, provided by the branch secretary, Mr. I. T. Watkins, thanks to the generosity of Westinghouse Brake and Signal Co. Ltd. In this unit, six "horses" were successfully operated by Midland Branch committee members, all the expenses associated with prizes being donated by local firms. The pictures below show some of the officers and principal guests.

Left to Right—Mr. and Mrs. P. Burns-Farquhar (Secretary, Metal Finishing Association), Mr. and Mrs. J. D. Beddows, Mrs. and Mr. C. R. Darby (Chairman, Midlands Branch Institute of Metal Finishing), Mr. and Mrs. C. Wharrad (Chairman, Metal Finishing Association)



Industrial News *Home and Overseas*

Liquid Hydrogen and Helium

A new plant for producing liquid hydrogen and/or liquid helium is now in service at the **British Oxygen** Scientific Division, at Morden, Surrey. It will help the Scientific Division to meet the rising demand from industry and research bodies for the two liquefied gases. The first plants in the U.K. for producing liquid hydrogen and liquid helium on a commercial basis began operating at Morden during last year.

A Birmingham Event

On Wednesday, March 22, the **Birmingham Metallurgical Society** will hold its annual dinner and dance at the Pavilion Suite, Edgbaston, Birmingham. The President of the Society, Mr. L. G. Beresford, will hold a reception of members and guests at 7 p.m.

Applications for tickets to this event should be made to the secretary of the society, c/o Brown Bayley Steels Ltd., 21 Bennetts Hill, Birmingham, 2.

An Interesting Lecture

Organized by the **Institution of Electrical Engineers,** this year's Faraday Lectures are being given by Mr. L. J. Davies, C.B.E., M.A., on the subject "Transistors—and all that", and last week they were given in Birmingham and Leicester. The object of the series is to present to the general public, progress and developments in the electrical industry, and the lectures are given in a number of centres throughout the country.

The lecturer, Mr. Davies, is director of research and education at A.E.I. Limited, Rugby, and he describes the characteristics of semiconductor materials, emphasizes the importance of controlled amounts of impurities in the metals used, and demonstrates electron flow and its effects in some of the applications to which semiconductors are used. Looking to the future, Mr. Davies touches on some of the possibilities before transistors, and forecasts an even greater usage than they have achieved at present.

International Meeting

Early notice is given of the 5th International Meeting of the Centro Leghe Leggeri AIM, which is to be held in Milan on October 7 to 9 this year. The subject of the meeting will be "Surface Treatments of Aluminium".

On this occasion the presentation of the 4th Guido Donegani Gold Medal award for light metallugry will be made, and during the meeting attention will particularly be given to the anodic oxidation, and to the chemical and electrochemical preparation, problems.

Health in the Factory

Changes in the maximum permissible concentrations of toxic substances in factory atmospheres are published as an amendment to the list appearing in "Toxic Substances in Factory Atmospheres", a safety, health and welfare booklet issued by the Ministry of Labour last year.

The figures of maximum permissible concentration given in the booklet are based on those formulated by the American Conference of Governmental Industrial Hygienists, and this first amendment brings these figures up-to-date. Also included is an explanatory note on the basis of the figures and the manner in which they should be interpreted.

The booklet gives information about certain dusts and fumes likely to be injurious to health or cause discomfort if the figure of maximum permissible concentration is exceeded. It also describes various practicable measures for protection against inhalation of dust and fume.

Showing at Leipzig

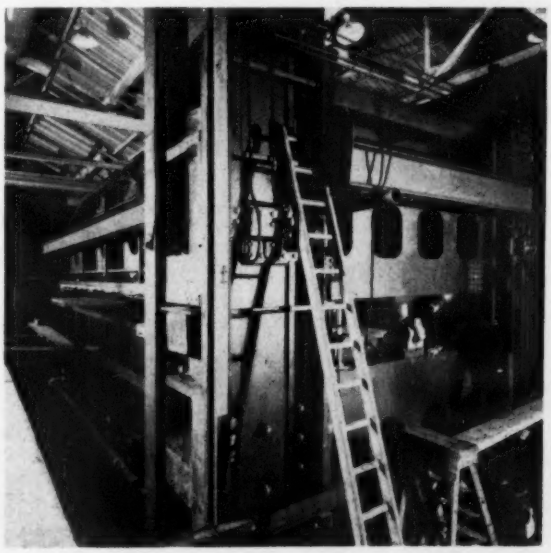
Probably the smallest thing on show at the forthcoming Leipzig Spring Fair will be a tube finer than a human hair, exhibited by **Tube Investments Ltd.** It will be mounted in a 64 in. length of seamless carbon tube and contained under water. Air will be blown through the fine tube, so that the bubbles formed act as a means of identification.

New Press Installed

A heavy press capable of exerting a thrust of 3,000 tons has been supplied to the de Havilland Aircraft Company Ltd. by **Head Wrightson Teesdale Ltd.** This press is designed for the Redux process of metal to metal bonding by adhesion under temperature and pressure control. It has a clear table access of 36 ft. by 9 ft. and is of welded construction, each platen comprising four fabricated H-sections, tied together at the ends by heavy cross-beams.

The four main rams are each 750 tons capacity, single acting, and are arranged within the corner posts. They are flange mounted to the top platen with pivot reactions between the rams and thrust plates. Upward travel is arranged through four secondary rams, each of 100 tons capacity and mounted in line with the main rams. Automatic levelling of the press is achieved by differential control between main and secondary cylinders.

Process controls for Reduxing operations, together with the necessary press controls, are housed in a combined cubicle suitably positioned to give a clear view of the press. The pumps and valve assemblies are arranged below floor level adjacent to the press, and the two pre-fill tanks are positioned above the cylinders, between the corner posts, one at each side. Guards are arranged at all access points, and safety keys are provided to ensure that all guards are proved down before operation of the press can commence.



The press manufactured by Head Wrightson Teesdale Ltd. for the de Havilland Aircraft Company Ltd.

Aluminium Roofing

One of the latest buildings to be roofed with aluminium is the Group Medical Practice Centre in Braidcraft Road, Glasgow, for the roofing of which aluminium sheet of 22 gauge, supplied by **The British Aluminium Company Ltd.,** in the form of "Lokroll 12", 13 cwt. in all, has been used.

For Retired Employees

At the forging works of **Garringtons Limited,** the chairman, Mr. R. P. Brookes, has created, for all retired members of the company with twenty-five years' service and over, a lounge at the Darlaston works for their use at any time of the day. The room, to be known as the "Evergreen Club", has been fitted out with easy chairs, carpets, central heating, bookshelves, television, and radio, etc., while close at hand is the staff canteen and bar at which the "Residents" may obtain refreshments at any time.

The official opening of the club room, which was followed by a buffet luncheon, took place on February 24 last, when the chairman of the company performed the opening ceremony by handing the key to

Mr. George Bailey, a 69-year-old retired member who has served the company for over 50 years.

Trade with Russia

At a recent preview held in London, **Telcon Metals Limited** presented some features of the stand which they will occupy at the forthcoming British Trade Fair to be held in Moscow this year. The stand will contain products of the Telcon group, also Thomas Bolton and Sons Ltd., Connollys (Blackley) Ltd., S.D. Syndicate Ltd., and Telcon Plastics Ltd.

Products in beryllium copper in all forms will be shown, including a wide range of safety tools, also glass-sealing alloys, electrical resistance alloys, and vacuum-melted alloys for a wide variety of applications. Other items to be featured will include copper, brass and bronze strip, extruded and drawn sections for electrical and other purposes, commutator bars and segments in H.C. copper, "Combarloy" and zirconium-copper. Also "Ardoloy" cemented carbide dies for drawing, extrusion and other purposes.

Metal Finishing

News from **Albright and Wilson (Mfg.) Ltd**, is that they have entered into an agreement with Hanson-Van Winkle-Muning, of Matawan, New Jersey, a long-established company in the metal finishing industry in the U.S.A. This agreement means a great extension to the existing range of plant which the British firm provides to operate their specialist metal finishing processes, notably "Phosbrite" chemical polishing solutions and "Plusbrite" addition for nickel and silver plating.

It is understood that Albright and Wilson are at present completing the installation of a very large automatic chemical polishing and anodizing plant for one of the Midlands' big companies. This plant has been designed to meet the needs of greatly increased production and will be in operation shortly.

More Tonnage Oxygen

A third 200-tons-a-day oxygen plant is being built by the **British Oxygen Company Ltd.** for Richard Thomas and Baldwins Ltd. for their new steelworks near Newport, Mon. The new plant is scheduled to be ready for operation early in 1963, and brings the total daily capacity of plant to be installed and operated by B.O.C. at Spencer Works to 600 tons of high-purity oxygen. The two first 200-ton plants are scheduled to be ready for operation towards the end of this year.

Nigerian Tin Smelter

According to reports from Northern Nigeria, **Consolidated Tin Smelters Limited** is to form a company in Nigeria —the Makere Smelting Company—to smelt tin ore from the Jos tin mines. Provision is made in the articles of the company for Nigerian participation in the shareholding.

In London, a spokesman for Consolidated Tin Smelters added that the smelter is expected to be opened some time this year, and would be capable of handling the entire Nigerian tin output. At present, the ore mostly comes to the United Kingdom for smelting.

Training Die-Casters

With the rapid growth, during the past decade, of the die-casting industry, a shortage of skilled die-casters has prevailed. The difficulty of getting men accustomed to this type of work has led **Alloy Pressure Die Products Ltd**, of Willenhall, Staffs., to institute training for some of the younger lads in their employ. An E.M.B. No. 12 machine has been set up at the end of the foundry, removed from the main production machines. Here, screened from the remainder of the shop, the trainee is instructed in the operation of the machine and allowed to work at his own pace. Simple unit dies which present no major casting problems are used, and although every effort is made to encourage good work, the youths are allowed to get the feel of the machine, and any scrap produced is regarded as part of the training process.

The system has already proved its worth and, in the die-casting shop and in the toolroom, it is felt that the company's own trainees are among the best workers they have.

Formability of Sheet Metal

At the **Birmingham Metallurgical Society** meeting on Thursday last week, Mr. D. H. Lloyd, F.R.I.C., F.I.M., chief metallurgist of Fisher and Ludlow Ltd., gave a review of experience in "Testing Sheet Metal for Deep Drawing". Praising the work of Professor Swift, he discussed briefly the background history to modern deep drawing techniques. Describing the Swift cup drawing test and the Olsen ball penetration test, he pointed out that these alone did not give a full assessment of performance in complex press tool operations. He dwelt at some length on the "R-value" and showed records of tests correlating this value with hardness, Olsen test and Swift cup drawing results, showing how these correlations can be used to diagnose production shop problems. Close co-operation between metallurgists at the suppliers' works and those at the users' works was, he emphasized, of great value in ensuring suitable supplies of material.

Copper Brand Registered

Registration of the following brand of electrolytic copper cathodes under Class B(1) of the Standard Copper Contract has been approved by the Committee of the London Metal Exchange, and such brand will constitute a good delivery against all contracts maturing after March 2, 1961:—Brand "M.E."; producer La Metalo-Chimique S.A., Beerse-laz-tournhout, Belgium.

News from Scotland

A major works and warehouse has been opened by **R. and J. Bow Limited** at 400 Cathedral Street, Glasgow, to handle anti-corrosives, joint sealing materials, keying and fixing materials, degreasants, and a wide variety of allied specialities for the engineering and constructional field.

The Nobel Division of **Imperial Chemical Industries Limited** have received planning permission for administrative offices at Ardeer, adjoining the production unit.

A Cyprus Discovery

It has been announced by the Geological Department of the Government of Cyprus that a new metalliferous area has been discovered on the eastern slopes of Mount Olympus. The official announcement said the area, near the village of Ayios Joannis, in the Pitsillia district, appears to contain copper pyrites and that work so far has yielded a "small quantity of rich ore".

In the new zone experts have established "traces of prospecting in ancient times", but so far no dross has been discovered in the region. The Government has ordered geochemical tests in the new metalliferous zone, it was stated.

Welding and Brazing Materials

Under the trade name of "Fontargen", a comprehensive range of low heat input metal joining alloys is now being marketed by **Welding Improvements Ltd.** This range comprises more than 60 types of coated arc welding electrodes; also rods and fluxes for use with oxy-acetylene, gas-air, induction, resistance, furnace and similar heating methods.

The range is divided into groups for application to steels, cast iron, stainless steels, copper, brass, bronze, light alloys, nickel and its alloys; other types include a full selection of silver brazing alloys, special soft solders, surfacing alloys for heat-, wear-, and corrosion-resistance, and electrodes for cutting and gouging all metals.

Power Step-up

Four castings, weighing on an average ten tons each, have recently been supplied by the **David Brown Foundries Division** for turbines which will be among the biggest electrical generating units in this country. They will be installed at the Central Electricity Generating Board's power station at West Thurrock, Essex, and each turbine will have an output of 300 MW.

Technological Awards

A memorandum has been recently published entitled "Memorandum on Awards Conferred" by the National Council for Technological Awards. It repeats, and in some cases amplifies, the information given in the Council's original memorandum, and also includes brief details of the award of Membership of the College of Technologists.

New Premises

An announcement from **British Insulated Callender's Cables Ltd.** states that, as from Monday next, March 13, their Ipswich branch is moving to new and larger premises at 1 Benezet Street, with the telephone number of Ipswich 57265. The branch will continue under the management of Mr. L. de Wynter.

Seam-Welding Blanks

A wider range of rough-machined seam-welding wheel blanks in Mallory 3 can now be supplied from stock, it is announced by **Johnson, Matthey and Company Ltd.** In the interests of international standardization, the blanks are now available in metric sizes, as recommended in B.S.3067. The new range includes all the commonly used sizes listed in the specification, and the metric sizes are very close to the superseded inch series.

Aluminium in Japan

According to news from Tokyo, Mitsubishi Chemical Industries Limited, a leading Japanese chemical producer, has concluded contracts with a French aluminium company and a Norwegian chemical firm for technical assistance to start primary aluminium production.

Mitsubishi Chemical Industries is one of two Japanese firms planning to start aluminium production, in addition to three existing producers.

Under the current contract with the Pechiney Compagnie de Produits Chemiques et Electrometallurgiques of France, Mitsubishi Chemical Industries is to receive technical aid for the construction and operation of large electric cells of 100,000 amperes for aluminium smelting. The contract with the Electro Kemisk A/S of Norway provides for technical assistance on Soderberg vertical spike electrodes required for the Pechiney electric cells.

Mitsubishi Chemical Industries said it planned to complete the construction of plants for alumina and aluminium production in Naoetsu, Northern Japan, by October 1962, and then begin production of 30,000 tons of primary aluminium per year.

Aluminium Container Production

A huge increase in the use of aluminium by the rapidly growing shipping container industry over the next decade was predicted last week by the Aluminum Company of America. Approximately 7,000,000 lb. of aluminium is now formed annually into the big boxes, which can contain single shipments large enough to furnish a five-room house, Alcoa estimated. In 1970, however, no less than 185,000,000 lb. of the light metal will be earmarked for containers, Alcoa forecasts.

Over four-fifths of the aluminium containers in use today are serving steamship lines, and 15 per cent are in use by the U.S. railways. The trucking industry will become a major user in the next eight to ten years, Alcoa predicted.

Books for Industry

Organized by the technical and scientific group of the Publishers' Association and the Booksellers' Association (Midland Branch), an exhibition of books for industry is being staged at the Engineering Centre, Stephenson Place, Birmingham, on Tuesday, Wednesday and Thursday of next week (March 14 to 16).)

The object of this three-day exhibition is to put Midland's industry in touch with the technical facts and ideas which lead to efficiency and profit. The exhibition will be opened on Tuesday by Dr. P. F. R. Venables, the Principal of the College of Advanced Technology, at 12 noon, and the general times of access to the exhibition each day are from 10 a.m. to 9 p.m.

Import Duty

It is understood that the application for the removal of the import duty on aluminium lithium hydride made to the Board of Trade in July last year has now been withdrawn.

Prices Reduced

Following recent reductions in the prices of their silicon diodes, **Westinghouse Brake and Signal Company Limited** have now announced substantial reductions, amounting in some cases to 50 per cent, in the prices of Trinistor silicon controlled rectifiers.

In addition, a new range of Trinistors, type CS32, with current ratings of 16 amp. and voltage ratings of 25-400 volt, has been introduced and supplements the existing CS31, 25 amp. range.

Cybernetics

It is announced by the International Association for Cybernetics that the Proceedings of the Second International Congress held at Namur, Belgium, in September, 1958, have just been issued. This publication, which includes more than 1,000 pages, with diagrams, and 80 of the Papers read at the Congress by scientists from many countries, is available from the secretariat of the Association at rue Basse-Marcelle, No. 13, Namur, Belgium.

Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 126 tons to 10,019 tons, comprising London 4,291, Liverpool 3,751 and Hull 1,977 tons.

Copper stocks rose 315 tons to 15,390 tons, distributed as follows: Liverpool 12,165, Birmingham 100, Manchester 1,950 and Hull 50 tons.

Lead duty free stocks fell 583 tons to 6,580 tons, while in bond stocks were unchanged at 3,867 tons. All supplies were in London.

Zinc duty free stocks fell 203 tons to 3,074 tons, while in bond stocks fell 25 tons to 325 tons, comprising London duty free 872 tons and in bond 325 tons, Liverpool duty free 2,172 tons and in bond nil tons, Glasgow duty free 30 tons and in bond nil tons.

A Golf Meeting

Early notice is given of the Spring meeting of the **National Association of Non-Ferrous Metal Merchants' Golfing Society,** which this year is to be held on Wednesday, May 17, at the Wentworth Golf Club, Surrey.

The annual general meeting of the Society will take place on the previous day (May 16) followed by dinner at the May Fair Hotel, London, W.1. Full details of the programme may be obtained from Mr. G. B. Garnham, of J. B. Garnham and Sons Ltd., Plantation House, Mincing Lane, London, E.C.3.

An Election

It is reported that **Head Wrightson Processes Ltd.** has been elected to membership of the Cooling Tower Institute. We understand that this company is the only British manufacturer to be accepted by the Institute, which was formed in America over ten years ago to advance the technology, design and performance of industrial water cooling equipment, and to conserve water as a natural resource.

In association with the Fluor Products Co., of California, U.S.A., Head Wrightson have for many years been concerned in a programme of research and development into improved methods of cooling, and recently introduced a new range of cooling towers for small industrial duties. The cooling, heating and treatment of water forms the basis of a comprehensive service available to all process plant operators.

Measuring Unit

A new dewpoint measuring unit is announced by **Shaw Moisture Meters** for permanent installation to measure moisture in dry gas or air lines. A small flow of the gas or dry air of which the moisture content is required to be indicated or controlled, is taken through the measuring unit. The unit contains a replaceable ceramic filter, and also the sensing probe which is connected to an indicating or recording instrument. The actual sensing element is despatched in a sealed packing, in which it is stored until after the measuring unit is installed, and purged with dry gas for an hour or two to dry it. No attention whatever is needed, and the range of the instrument is such that no gas has yet been encountered in practice which is too dry for the moisture to be indicated.

As the range is down to −150°C. dewpoint, there are many applications for the new device in atomic power stations, chemical, semi-conductor, refrigeration, food, metallurgical and radio valve manufacturing industries. It is suitable for almost all gases.

Sales Project

An agreement has been entered into by Pfizer Ltd. and its subsidiary, Kemball, Bishop and Co. Ltd., with **Diversey (U.K.) Limited,** under which the latter handles all sales in the United Kingdom of sodium gluconate or gluconic acid, when required for use in bottle-washing or aluminium etching in the U.K.

Norwegian Aluminium

According to news from Oslo, A/S Ardal and Sunndal Verk, a State-owned aluminium producer, is planning to expand annual output capacity by 150,000 tons to 300,000 tons over the next ten years.

A B.B.C. Talk

Before anything can be judged as "up to standard", a standard has to be established. This is often far from easy, and in a B.B.C. "Science Survey" talk on Thursday, March 23 (Network Three), H. A. R. Binney, C.B., Director of the British Standards Institution, will describe the kind of technical problem that often has to be overcome before a British Standard can be evolved. This talk will be repeated on the following Saturday morning in the Home Service.

New Products

It is announced that **D. G. Bennett Chemicals** have recently introduced two new surface active agents. "Serfal 6639", is a non-ionic wetting agent with very low foaming properties, and "Serfal CS.170" a non-ionic emulsifier for wax, olein and mineral oils which is also useful as a detergent in alkaline degreasing baths.

Forthcoming Meetings

March 13—Institute of Metals. Scottish Local Section. Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow. "Metallurgy and Musical Instruments." W. H. Tait. 6.30 p.m.

March 13—Society of Instrument Technology. Bristol Section. Department of Physics, Bristol University. "Industrial Use of Precision Scales." P. A. McKeown. 7.30 p.m.

March 14 — Institution of Works Managers. Birmingham Branch. College of Technology, Birmingham. "Modern Packaging and its Problems." C. Bloom. 7 p.m.

March 14—Institute of British Foundrymen. Slough Section. Lecture Theatre, High Duty Alloys Ltd., Slough. "Art Bronze Founding." A. L. Parrott 7.30 p.m.

March 15 — North-East Metallurgical Society. Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough. "Properties of Metals at Very Low Temperatures." Dr. C. J. Adkins. 7.30 p.m.

Metal Market News

FAIRLY steady conditions obtained on the Metal Exchange last week, but the bull account which was building up in copper collapsed on Wednesday when news came through that the political atmosphere in Rhodesia had markedly cooled down. In the Congo, however, the situation remains very serious, although there is no news yet of any loss of production at the mines in Katanga. The market has long ago accepted the fact that the whole situation in Africa is grave and could lead to a stoppage in supplies of copper should matters take a turn for the worse. That being so, it may be said that the price is a pound or two higher all the time than it would be were the situation settled and peaceful. However, it must be accepted that we shall have to live with African conditions as they are today for a very long time, for it is impossible to visualize any rapid improvement. In the United States, the situation certainly does not appear to be any worse, and may even be rather better, at any rate on the non-ferrous side of the picture. In regard to the copper situation over there, the January figures of consumption in the mills are decidedly encouraging and rather contradict the view that the usage of copper in the States is very much off. Moreover, the cuts in production outside the United States are beginning to show up pretty clearly, and that is encouraging from the point of view of those who hope to see the quotation higher.

Another factor that operated last week to stiffen the copper quotation was the first rumbling of wage talks due to take place in anticipation of contracts expiring at June 30 next. It is understood that Kennecott's Western Division is implicated in this reconsideration of the wage structure, and the output in question is some 30,000 tons per month. It is, of course, early days as yet and it would be very wrong to jump to the conclusion that there must inevitably be a strike, but the disastrous stoppages in 1959 are still fresh in mind, and over the years strikes have unfortunately been a feature of the American scene. Like the African situation, this strike danger in the States is something we shall have to live with for some months to come. Consumers did not seem to be much in evidence last week, but then they very rarely are when the copper market shows a downward trend.

Rather unexpectedly there was an increase of 325 tons in warehouse stocks of copper, bringing the total again over 15,000 tons to 15,075 tons. A modest contribution to the sum total of curtailment was announced by the O'Kiep Copper Co. in the shape of a 10 per cent cut in output, equivalent to 3,000 tons per annum. Although, as already mentioned, business in physical copper was light, dealing in futures was fairly active, with a turnover of about 15,000 tons. Most satisfactory of all was the return of a contango, for at the close cash stood at £225 15s. 0d. and three months at £227, these prices showing a loss of £4 15s. 0d. in prompt and of only £3 in forward. Tin closed 30s. down for cash at £803 and unchanged forward at £806. The turnover was above average at 1,500 tons. Lead lost ground to the extent of 22s. 6d. cash and 20s. three months. Closing prices were £64 7s. 6d. and £65 5s. 0d. Turnover was 8,500 tons. At £84 cash, zinc showed a loss of 17s. 6d. and three months was 25s. down at £82 10s. 0d. Some 6,500 tons changed hands.

Birmingham

Although there is still plenty of leeway to make up, the motor trade continues to recover ground. Orders for raw materials and components are slowly expanding. An optimistic view was taken by Major C. R. Dibben, chairman of the Midland Regional Board for Industry, at its monthly meeting. He said that manufacturers of machine tool and other capital goods, together with the building and civil engineering industries, were as busy as ever they had been. There were still persistent demands for skilled men. The optimism, however, was subject to continuing efforts to increase productivity and keep prices steady, and secondly, a sustained effort to increase sales in existing overseas markets and in finding new markets abroad.

The iron and steel industry is benefiting from greater activity in the motor trade through increased demands for sheets and castings. Some iron foundries have already returned to full employment. No difficulty is experienced in obtaining supplies of pig iron from the furnaces. Mills rolling heavy steel joists, sections and plates are assured of full employment during the current quarter. Exports of steel have shown expansion. A substantial tonnage of imported semis arrived last month. Order books of machine tool makers are lengthening.

New York

Copper futures were slightly lower in fair dealings at the week-end. In physical copper, dealers noted continued quiet conditions, while custom smelters and producers indicated fair demand. Leading producers have begun selling for April, but so far sales for that month were light. Scrap copper was softer, declining by ¼ cent per lb. Offerings were freely available. Tin was firmer. Modest dealer business was reported. Lead and zinc were quiet. In late trading, tin was very steady. There was fair dealer business in forward positions.

The United States will attempt to get world lead and zinc producers to cut back 1961 lead production by some 100,000 tons, administration officials reported, according to the *Journal of Commerce*. The United States proposal—which might include an offer to barter United States surplus foods for the surplus metal production—would be made at a March 20 meeting of the International Lead and Zinc Study Group, the *Journal* said.

At the same time, the *Journal of Commerce* said that it learned that the administration would not support legislation which would increase United States production of the metals until after the results of the meeting were known. That apparently meant that the State and Interior Departments would oppose the Bill at present before the House Interior Committee which would provide subsidies for small United States lead and zinc producers. The officials added that the situation could change if the voluntary production cutback was not approved by the world producers. The officials added, however, according to the *Journal*, that several international producers had already indicated a willingness to cut back output.

Chile

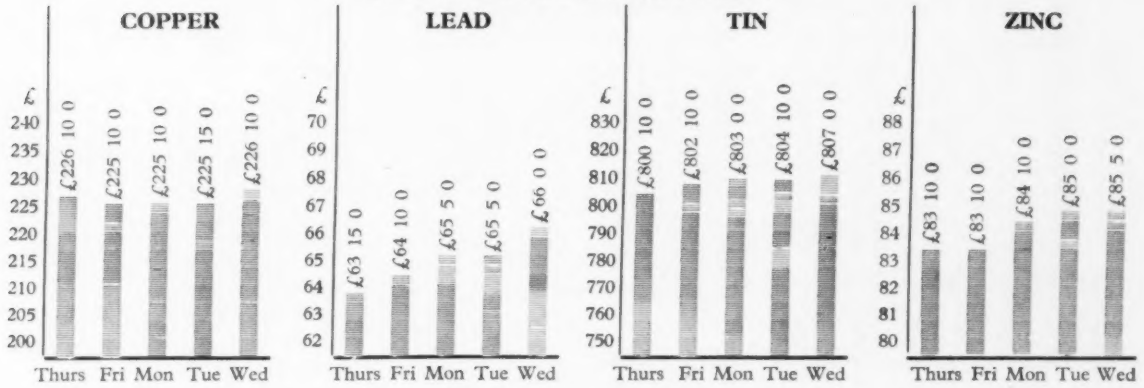
Preliminary work has been completed at a new copper ore deposit near Santiago which will eventually add another 60,000 short tons to the output of the medium copper mining industry. The deposit, called Rio Blanco, is some 40 miles north-east of Santiago, and was purchased about a year ago by the Cerro Corporation. Prospecting has revealed a deposit of some 120 million short tons of copper ore with a recoverable copper content of 1,900,000 short tons. The complete installations will include crushing mills, filter plants and a pipeline down to the city of Los Andes for the copper concentrates.

According to a Cerro Corporation statement, total investments are estimated at 95 million dollars, of which 55 million will be spent on local salaries and purchases at the completion of the development work within five years. The company added that negotiations with the Chilean Government regarding the terms under which the company will operate are almost complete.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 2 March to Wednesday 8 March 1961



Primary Metals

All prices quoted are those available at 2 p.m. 8/3/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	217	10	0
Antimony Metal 99%	„	210	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	196	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	0
Calcium	„	2	0	0
Cerium 99%	„	15	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite	per unit		8	10
Copper H.C. Electro	ton	226	10	0
Fire Refined 99·70%	„	225	0	0
Fire Refined 99·50%	„	224	0	0

		£	s.	d.
Copper Sulphate	ton	76	0	0
Germanium	grm.		—	
Gold	oz.	12	11	2
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	66	0	0
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, AZ91X		1	11¾-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	69	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	122	0	0
Silver Spot Bars	oz.		6	7⅛
Tellurium Sticks	lb.	2	0	0
Tin	ton	807	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	84	8	1½
Dust 95/97%	„	125	0	0
Dust 98/99%	„	131	0	0
Granulated 99+%	„	109	8	1½
Granulated 99·99+%	„	125	2	6

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg≏£/ton	**Canada** c/lb≏£/ton	**France** fr/kg≏£/ton	**Italy** lire/kg≏£/ton	**Switzerland** fr/kg≏£/ton	**United States** c/lb≏£/ton
Aluminium		26.00 210 12	2.43 179 11	370 216 1	2.50 210 5	26.00 207 4
Antimony 99.0			2.30 170 0	500 292 0		29.00 231 2
Cadmium			15.75 1,069 0			150.00 1,195 10
Copper						
Crude				435 254 0		
Wire bars 99.9						
Electrolytic	31.75 232 1	27.50 222 15	3.19 235 14		2.75 231 5	29.00 231 6
Lead		10.00 81 0	.94 69 9	163 96 3	.78 65 11	11.00 87 13
Magnesium						
Nickel		70.00 567 0	9.00 665 2	1,170 683 5	7.50 630 15	74.00 589 15
Tin	111.50 814 19		11.33 837 5	1,500 876 0	9.65 811 11	102.00 812 18
Zinc						
Prime western		12.00 97 4 0				
High grade 99.95		12.60 102 1 0				
High grade 99.99		13.00 105 6 0			1.10 92 10	
Thermic			1.20 88 13			
Electrolytic			1.28 94 13	191 111 10		13.00 104 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 8/3/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10 .... „	221	0	0
B.S. 1490 L.M.11 .... „	215	0	0
B.S. 1490 L.M.12 .... „	223	0	0
B.S. 1490 L.M.13 .... „	216	0	0
B.S. 1490 L.M.14 .... „	224	0	0
B.S. 1490 L.M.15 .... „	210	0	0
B.S. 1490 L.M.16 .... „	206	0	0
B.S. 1490 L.M.18 .... „	203	0	0
B.S. 1490 L.M.22 .... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	171	0	0
B.S. 1490 L.M.2 .... „	174	0	0
B.S. 1490 L.M.4 .... „	180	0	0
B.S. 1490 L.M.6 .... „	180	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ..... ton	245	0	0
BSS 1400 AB.2 ..... „	253	0	0

***Brass**	£	s.	d.
BSS 1400-B3 65/35 .. ton	176	0	0
BSS 249 ..... „		—	
BSS 1400-B6 85/15 .. „	225	0	0
***Gunmetal**			
R.C.H. 3/4% ton .... „		—	
(85/5/5/5) LG2 ..... „	220	0	0
(86/7/5/2) LG3 ..... „	230	0	0
(88/10/2/1) ..... „	284	0	0
(88/10/2/½) ..... „	294	0	0
***Manganese Bronze**			
BSS 1400 HTB1 ..... „	196	0	0
BSS 1400 HTB2 ..... „	213	0	0
BSS 1400 HTB3 ..... „	231	0	0
Nickel Silver			
Casting Quality 12% „	235	0	0
„ „ 16% „	250	0	0
„ „ 18% „	290	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) ..... „	310	0	0
B.S. 1400 L.P.B.1 „	242	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ..... ton	258	0	0
15% ..... „	261	10	0
Phosphor Tin			
5% ..... „	881	0	0
Silicon Bronze			
BSS 1400-SB1 ..... „	285	0	0
Solder, soft, BSS 219			
Grade C Tinmans ... „	369	10	0
Grade D Plumbers .. „	295	15	0
Grade M ..... „	406	10	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „ „		—	
Zinc Alloys			
BSS 1004 Alloy A .. ton	118	12	6
BSS 1004 Alloy B.... „	122	12	6
Sodium-Zinc ..... lb.		2	7

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.	2	10½	
Sheet 18 S.W.G. „	3	0½	
Sheet 24 S.W.G. „	3	3½	
Strip 10 S.W.G. „	2	10½	
Strip 18 S.W.G. „	2	11½	
Strip 24 S.W.G. „	3	1	
Circles 22 S.W.G. „	3	4½	
Circles 18 S.W.G. „	3	3½	
Circles 12 S.W.G. „	3	2½	
Plate as rolled ..... „	2	10	
Sections ..... „	3	4	
Wire 10 S.W.G. .... „	3	1½	
Tubes 1 in o.d. 16 S.W.G. ..... „	4	4	
Aluminium Alloys			
BS1470. HS19W.			
Sheet 10 S.W.G. „	3	3	
Sheet 18 S.W.G. „	3	5½	
Sheet 24 S.W.G. „	4	1	
Strip 10 S.W.G. „	3	3	
Strip 18 S.W.G. „	3	4½	
Strip 24 S.W.G. „	4	0½	
BS1477. HP30M.			
Plate as rolled ..... „	3	1	
BS1470. HC15WP.			
Sheet 10 S.W.G. „	4	3	
Sheet 18 S.W.G. „	4	8½	
Sheet 24 S.W.G. „	5	8½	
Strip 10 S.W.G. „	4	4	
Strip 18 S.W.G. „	4	8½	
Strip 24 S.W.G. „	5	4½	
BS1477. HPC15WP.			
Plate heat treated ... „	3	10½	
BS1475. HG19W.			
Wire 10 S.W.G. „	4	2	
BS1471. HT19WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „	5	5	
BS1476. HE19WP.			
Sections ..... „	3	4	
Split tube			
19 S.W.G. (⅛") ..... „	4	2	
20 S.W.G. (⅜") ..... „	3	11	
21 S.W.G. (⅛") ..... „	4	1	
22 S.W.G. (¼") ..... „	4	11	
Welded tube			
14 to 20 S.W.G. (sizes ½" to 1½") .... „	3/10½ to 5/8½		

Brass			
Tubes ..... lb.	1	10	
Brazed Tubes ..... „	3	3	
Drawn Strip Sections „	3	2½	
Sheet ..... ton	200	5	0
Strip ..... „	200	5	0
Extruded Bar ..... lb.	2	0½	
Condenser Plate (Yellow Metal) ..... ton	188	0	0
Condenser Plate (Naval Brass) ..... „	200	0	0
Wire ..... lb.	2	8½	
Beryllium Copper			
Strip ..... „	1	4	11
Rod ..... „	1	1	6
Wire ..... „	1	4	9
Copper			
Tubes ..... lb.	2	2½	
Sheet ..... ton	262	10	0
Strip ..... „	262	10	0
H.C. Wire ..... „	278	5	0
Cupro Nickel			
Tubes 70/30 ..... lb.	3	6½	

Lead			
Pipes (London) ..... ton	107	0	0
Sheet (London) ..... „	104	15	0
Tellurium Lead ..... „	£6 extra		
Nickel Silver			
Sheet and Strip 10% .. lb.	3	10½	
Wire 10% ..... „	4	3½	
Phosphor Bronze			
Wire ..... „	4	1	
Titanium (1,000 lb. lots)			
Billet 4½" to 18" dia..... lb.	47/-	48/-	
Rod ½" to 4" dia..... „	85/-	53/-	
Wire ·036"-232" dia.... „	159/-	99/-	
Strip ·001" to ·048".... „	350/-	68/-	
Sheet 8'×2'. 20 gauge „	73/-		
Tube, representative average gauge ..... „	198/-		
Extrusions ..... „	90/-		
Zinc			
Sheet ..... ton	123	5	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 7/3/61.

Aluminium	£
New Cuttings	141
Old Rolled	114
Segregated Turnings	74
Brass	
Cuttings	160
Rod Ends	143
Heavy Yellow	136
Light	131
Rolled	150
Collected Scrap	135
Turnings	137
Copper	
Wire	205
Firebox, cut up	202
Heavy	200
Light	197
Cuttings	207
Turnings	184
Braziery	177

Gunmetal	£
Gear Wheels	200
Admiralty	200
Commercial	184
Turnings	179
Lead	
Scrap	55
Nickel	
Cuttings	—
Anodes	555
Phosphor Bronze	
Scrap	184
Turnings	179
Zinc	
Remelted	75
Cuttings	64
Old Zinc	44

Financial News

George Edmonds

Group net profit 1960 £21,469 (£9,292). Dividend is 17½ per cent (12½). Property, plant, etc., £148,640 (£81,824). Current assets £98,907 (£96,990), liabilities £83,041 (£30,426).

M. Mole and Son

Net profit, 1960, £44,332 (£43,886) and dividend 11¼ per cent (same). Fixed assets £258,969 (£219,200), current assets £271,339 (£241,142) and liabilities £153,674 (£116,738). Commitments £11,500 (£15,000).

Petaling Tin

Net profit year ended October 31, 1960, £111,918 (£80,955) and dividend 35 per cent (20 per cent). Current assets £749,563 (£876,329) and liabilities £116,122 (£320,578). Total assets £1,918,436 (£2,075,392).

Barker Bros. Ltd.

Group net profit, 1960, £15,067 (£15,822), after tax £16,262 (£15,382). To Ordinary dividend 17½ per cent, £8,789 net (same). Preference £3,767 (same), forward £129,499 (£126,737). Current assets £416,283 (£413,150) and liabilities £66,905 (£71,933).

International Nickel Company

Net earnings of the International Nickel Company of Canada and subsidiaries for the year ended December 31, 1960, were 80,701,000 United States dollars, equal to $2·76 per common share, according to the annual report issued this week. These earnings compare with $85,157,000 or $2·91 per common share reported for 1959. Factors affecting earnings adversely last year were reduced deliveries of nickel produced from the company's own mines and plants, higher costs for labour and services and increased provisions for depreciation and income taxes.

During the year, the report stated, the company delivered 351,880,000 lb. of nickel —an all time high — compared with 317,040,000 lb. in 1959, and 205,800,000 lb. in 1958, the lowest point in a decade. These record deliveries included 51,410,000 lb. which made no contribution to earnings, having been acquired from the United States Government or its suppliers, and sold to the trade at the same prices at which it was acquired.

The annual report noted that largely as a result of increased European demand, nickel consumption in the Free World rose to a new high of approximately 515,000,000 lb., about 20 per cent above the previous record, established in 1959. Industries in Western Europe used an estimated 235,000,000 lb. of nickel last year, compared with 170,000,000 lb. in 1959. The company's copper deliveries were 292,540,000 lb. compared with 252,450,000 in 1959. Deliveries of the platinum metals — platinum, palladium, rhodium, ruthenium and iridium — were 359,300 oz. This compared with 384,600 oz. in 1959.

British Tin Investment Corpn.

Group net revenue, 1960, £481,281 (£276,055) and dividend 34 (22) per cent. Quoted investments £2,537,979 (£2,677,252), market value £8,371,912 (£8,124,394). Current assets £786,331 (£435,856) and liabilities £493,090 (£332,212).

An Acquisition

The directors of P. M. Pathe (Engineers) Ltd., general engineers, of Milton Works, Egerton Lane, Sheffield, 1, announce that they have acquired the entire share capital of Wassell and Clayton Ltd., engineers, of Park Works, Broomhall Street, Sheffield, 3. The head office of the Pathe Engineering Group of Companies, which also includes Heated Hoses Ltd., of Sheffield, has moved this week to Broomhall Street.

The directors state that their principal reason for buying Wassell and Clayton Ltd. is the shortage of space and engineering capacity required to fulfil the present and anticipated volume of business commitments. P. M. Pathe (Engineers) Ltd. have undertaken work for most of the larger companies in the Sheffield area and for many concerns in other parts of the country. Their work includes general engineering, machining, light fabrications, metal spraying and factory maintenance.

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (new francs per kilo):

Electrolytic copper scrap	(£225.7.0) 3.05
Heavy copper	(£225.7.0) 3.05
No. 1 copper wire	(£208.7.0) 2.82
Brass rod ends	(£164.1.0) 2.22
Zinc castings	(£65.0.0) 0.88
Lead	(£64.5.0) 0.87
Aluminium	(£134.9.0) 1.82

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£178.2.0) 305
Lead, soft, first quality	(£80.0.0) 137
Lead, battery plates	(£44.19.0) 77
Copper, first grade	(£216.1.0) 370
Bronze, commercial gunmetal	(£175.4.0) 300
Brass, heavy	(£148.18.0) 255
Brass, light	(£134.6.0) 230
Brass, bar turnings	(£148.18.0) 255
Old zinc	(£61.6.0) 105

Japan (Yen per metric ton):

Electrolytic copper	(£—)	275,000
Copper wire No. 1	(£—)	262,000
Copper wire No. 2	(£—)	247,000
Heavy copper	(£—)	245,000
Light copper	(£—)	205,000
Brass, new cuttings	(£—)	185,000
Red brass scrap	(£—)	212,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£218.12.0) 240
Heavy copper	(£209.10.0) 230
Light copper	(£182.4.0) 200
Heavy brass	(£132.1.0) 145
Light brass	(£95.13.0) 105
Soft lead scrap	(£52.16.0) 58
Zinc scrap	(£52.16.0) 58
Used aluminium unsorted	(£81.19.0) 90

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

B. T. West Limited (681556), 631a Wandsworth Road, S.W.18. Registered January 25, 1961. To carry on the business of machinery and metal merchants, etc. Nominal capital, £100 in £1 shares. Directors to be appointed by subscribers.

Fuller's Metal Works Limited (681987), 162 Liverpool Road, N.1. Registered January 30, 1961. Nominal capital, £100 in £1 shares. Directors: Alfred W. Fuller and Mrs. Elsie A. Fuller.

Henry Moss Castings Limited (682649), 201 Great Bridge Street, West Bromwich. Registered February 6, 1961. To carry on the business of manufacturers of and dealers in metals, etc. Nominal capital, £5,000 in £1 shares. Directors: Ernest Darby and Mrs. Beryl Darby.

Rigby Fuller Developments Limited (682698), 55 Welbeck Street, W.1. Registered February 7, 1961. To carry on business of metallurgists, ironfounders, etc. Nominal capital, £100 in £1 shares. Directors: Joseph H. Rigby and Eric R. Fuller.

J. and M. Parker Limited (682802), 44 Brass Street, Birmingham. Registered February 8, 1961. To carry on business of manufacturers of and dealers in metal and alloy goods, etc. Nominal capital, £5,000 in £1 shares. Directors: James T. Parker and Maurice J. Parker.

ASSOCIATED ILIFFE TECHNICAL BOOKS

Books Recommended by

METAL INDUSTRY

EFFECT OF SURFACE ON THE BEHAVIOUR OF METALS

Published for the Institution of Metallurgists. 21s. (By post 21s. 10d.)

INDUSTRIAL BRAZING

By H. R. Brooker and E. V. Beatson. 35s. (By post 36s. 6d.)

BEHAVIOUR OF METALS AT ELEVATED TEMPERATURES

Published for the Institution of Metallurgists. 21s. (By post 21s. 10d.)

HANDBOOK OF INDUSTRIAL ELECTROPLATING. 2nd Edition.

By E. A. Ollard, A.R.C.S., F.R.I.C., F.I.M. and E. B. Smith. 35s. (By post 36s. 5d.)

METAL INDUSTRY HANDBOOK AND DIRECTORY, 1960

21s. (By post 22s. 9d.)

Obtainable at all booksellers or direct from

ILIFFE BOOKS LIMITED
DORSET HOUSE
STAMFORD ST., LONDON, S.E.1.

Ring Failsworth 3176
& bring to your service
Mr. N. Lusby with
his expert advice.

A phone call....

to our representative,
when next you have alloy scrap
for disposal, for prompt
and efficient service on:-

NICKEL ANODES & CUTTINGS.
MONEL METAL.
FERRY METAL.
CUPRO NICKELS.
NICKEL SILVER.

Telephone:-
Sheffield
20092 Mr. G. S. Baigent
Manchester
Failsworth 3176 for Mr. N. Lusby
Birmingham
Calthorpe 2515 for O. B. Nyquist
(pronounced Kneekwist)

T. W. JOHNSON & CO. LTD.

40 WORTHING RD. SHEFFIELD 9

83 GEORGE ST., BALSALL HEATH, BIRMINGHAM

1 WOODFORD ROAD FAILSWORTH, MANCHESTER

D

THE STOCK EXCHANGE

Markets Busier Than For More Than A Year

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 6 MARCH	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1960-61 HIGH	1960-61 LOW	1959 HIGH	1959 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	31/6	+ 6d.	11	9	6 19 9	34/9	25/6	33/3	23/3
400,000	2/-	Anti-Attrition Metal ...	1/-		NIL	4	NIL	1/6	0/9	1/7½	1/-
43,133,593	Stk. (£1)	Associated Electrical Industries ...	46/9	+ 4/6	15	15	6 8 6	67/3	39/3	67/-	54/-
3,895,963	1	Birfield	51/3	+ 1/6	10	15‡	3 18 0	52/-	29/-	75/4½	46/-
4,795,000	1	Birmid Industries	81/9	+ 2/3	20	20D	4 18 0	81/9	56/-	75/6	46/9
8,445,516	Stk. (10/-)	Birmingham Small Arms	33/6	+ 6d.	17½QT	12½	3 10 9	33/6	18/4½	69/-	36/-
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/6		5	5	6 18 0	17/4½	14/4½	17/6	15/-
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/-	—4½d.	6	6	7 1 3	20/-	16/6	20/1½	17/6
500,000	1	Bolton (Thos.) & Sons	48/9	+ 5/-	12½	10	4 6 6	48/9	37/-	47/-	27/6
300,000	1	Ditto Pref. 5%	14/-		5	5	7 2 9	16/-	13/6	16/-	14/9
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	17/-		6	6	7 1 3	21/1½	16/9	21/6	18/9
18,846,647	Stk. (£1)	British Insulated Callender's Cables	57/9	+ 2/-	13½	13½	4 13 6	61/-	47/6	61/-	45/1½
20,456,599	5/-	British Oxygen Co. Ltd., Ord. ...	30/6		16	16	2 12 6	34/6	19/6	87/9	49/3
1,200,000	Stk. (5/-)	Canning (W.) & Co.	19/-	+ 2/-	15 + 8⅓C	25 + *2½C†	3 19 0	19/6	13/3	18/1½	12/3
60,484	1/-	Carr (Chas.)	1/6	+ 1½d.	NIL	12½	—	2/3	1/-	2/10½	1/3
555,000	1	Clifford (Chas.) Ltd.	28/9	+ 1/9	10	10	5 19 3	35/-	26/-	30/-	22/6
46,000	1	Ditto Cum. Pref. 6%	15/3		6	6	7 17 5	16/-	15/3	16/-	17/-
300,000	2/-	Coley Metals	4/3	+ 3d.	15	15	7 1 3	5/-	3/3	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	67/3	—1/3	20	15	5 19 0	80/-	60/6	77/3	57/9
5,399,056	1	Davy-Ashmore	159/3	+ 4/3	30‡	20	1 17 6	153/3	100/6	116/-	43/-
8,000,000	5/-	Delta Metal	23/-	+ 9d.	17½	31‡	3 16 0	28/-	18/7½	26/4½	11/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	46/3	+ 1/-	15	15	6 9 9	56/3	45/-	61/9	36/7½
1,155,000	1	Evered & Co.	44/-		10B	10 ϕ	3 0 0	42/9	29/-	42/6	30/-
18,000,000	Stk. (£1)	General Electric Co.	37/-	+ 4/6	10	10	5 8 0	51/6	29/3	50/6	30/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	53/-	+ 1/6	25	20	4 14 3	53/9	40/-	47/-	31/4½
1,037,492	5/-	Glacier Metal Co. Ltd.	15/-	+ 3d.	13	11½	4 6 9	15/9	11/1½	11/3	6/7½
2,500,000	5/-	Glynwed Tubes	24/-	+ 3d.	25¶	20	3 10 6	27/1½	17/7½	30/9	16/1½
7,228,065	10/-	Goodlass Wall & Lead Industries ...	41/-	+ 1/9	19L	16	3 9 6	41/6	33/4½	53/-	28/7½
696,780	10/-	Greenwood & Batley	25/-xcap		30W	30	6 0 0	27/-	23/9Z	130/-	75/-
792,000	5/-	Harrison (B'ham) Ord.	12/10½	+ 6d.	*20‡	*17½	3 17 9	15/4½	11/9	26/9	14/-
150,000	1	Ditto Cum. Pref. 7%	20/-		7	7	7 0 0	20/-	19/3	19/6	19/4½
1,612,750	5/-	Heenan Group	14/9	—6d.	13	15	4 8 3	15/3	10/-	19/6	7/4½
251,689,407	Stk. (£1)	Imperial Chemical Industries ...	71/9	+ 2/3	11½N	8	3 2 9	75/3	54/-	62/7½	33/1½
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/9		5	5	6 7 0	17/9	15/3	19/1½	15/6
29,184,	**	International Nickel	122½	+ 4½	$1.60	$1.50	2 8 0	122½	85½	201½	154½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/3		5	5	7 0 3	16/6	13/9	17/6	14/9
6,000,000	1	Ditto Ord.	60/3	—1/3	12	12D	3 19 6	66/6	45/-	50/3	27/3
600,000	10/-	Keith, Blackman	20/3		17½	17½E	8 12 9	32/6	17/9	32/-	25/-
320,000	4/-	London Aluminium	10/7½	+ 3d.	12	10	4 10 6	12/6	7/6	10/7½	5/3
765,012	1	McKechnie Bros. Ord.	54/-	—1/-	17½F	15F	6 9 6	71/6	54/-	62/6	39/9
1,530,024	1	Ditto A. Ord	52/6	—1/-	17½F	15F	6 13 3	69/3	52/6	65/6	38/9
1,108,268	5/-	Manganese Bronze & Brass	15/9	+ 6d.	20⅝	20⅝	6 12 9	18/9	13/4½	19/-	13/6
50,628	6/-	Ditto (7½% N.C. Pref.)	6/-		7½	7½	7 10 0	6/6	5/10½	7/9	5/9
26,361,444	Stk. (£1)	Metal Box	84/6		12M	13B	2 12 0	84/9	55/9	80/-	44/7½
415,760	Stk. (2/-)	Metal Traders	7/3		50	50	13 15 9	10/4½	7/1½	13/6	8/4½
160,000	1	Mint (The) Birmingham	36/9		10	10	5 8 9	39/-	33/6	35/-	22/-
80,000	5	Ditto Pref. 6%	76/3		6	6	7 17 6	80/-	75/-	80/-	69/-
5,187,938	Stk. (£1)	Morgan Crucible A	59/9	+ 9d.	13	12	4 7 0	62/3	47/6	52/6	30/-
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	16/-		5½	5½	6 17 6	18/6	15/4½	19/3	17/3
3,850,000	Stk. (£1)	Murex	42/9	+ 3d.	22½ J	15	6 0 6	45/-	35/3	76/4½	41/-
585,000	5/-	Ratcliffs (Great Bridge) Ord. ...	16/-	—3d.	10	10R	3 2 6	17/-	14/9	—	
195,000	5/-	Ditto 8% Max. Ord.	5/-		8	—	8 0 0	5/3	5/-	—	
1,064,880	10/-	Sanderson Kayser	38/-	+ 1/-	35‡	25	4 12 3	40/3	27/7½	56/-	27/9
3,400,500	Stk. (5/-)	Serck	17/9	—4½d.	12½	17½GD	3 10 6	25/-	15/3	26/-	12/-
8,035,372	Stk. (£1)	Stone-Platt Industries	66/-		15	15	4 11 0	66/-	52/3	63/6	42/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/-		5½	5½	7 6 9	18/7½	15/-	18/9	15/10½
35,344,881	Stk. (£1)	Tube Investments Ord.	80/6	+ 5/-	14	20	3 9 6	95/9	66/3	138/-	71/7½
41,000,000	Stk. (£1)	Vickers	32/-	+ 2/3	10	10	6 5 0	39/-	27/3	40/6	26/10½
750,000	Stk. (£1)	Ditto Pref. 5%	13/-		5	5	7 13 9	17/6	14/-	17/3	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	20/6		*5	*5	7 7 6A	24/3	20/-	25/9	20/6
4,594,418	1	Ward (Thos. W.) Ord.	73/-	—9d.	13‡	25	3 15 0	86/-	64/-	167/6	83/-
7,109,424	Stk. (£1)	Westinghouse Brake	40/6	—3d.	11	10	5 8 9	59/9	36/6	60/7½	39/-
315,895	2/-	Wolverhampton Die-Casting ...	9/9	+ 3d.	35	30	7 3 6	13/10½	8/3	13/1½	8/8½
591,000	5/-	Wolverhampton Metal	27/9		32½	27½	5 17 0	39/6	23/9	34/3	21/6
156,930	2/6	Wright, Bindley & Gell	4/1½	—1½d.	15	20‡	9 1 9	4/3	2/10½	4/3	2/6
124,140	1	Ditto Cum. Pref. 6%	13/6		6	6	8 17 9	15/3	13/3	14/3	12/10½
150,000	1/-	Zinc Alloy Rust Proof	5/-		40	30	8 0 0	5/6	4/-	3/10½	2/9

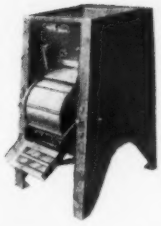
*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. ⊕The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. ϕ and 6½% from Capital Profits B and 50% capitalized issue. G and 1½d special distribution. F and special 5% tax free dividend H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. N Interim since increased. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13⅔%. Interim on smaller capital. P Calculated at 11½%. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. W Before capital reorganization. Calculated at 15%. Z After capital reorganization

Magnetic EXPERIENCE

IN

- SEPARATING
- EXTRACTING
- ELEVATING
- CONVEYING
- FILTERING
- LIFTING
- DETECTING
- HOLDING

60 YEARS

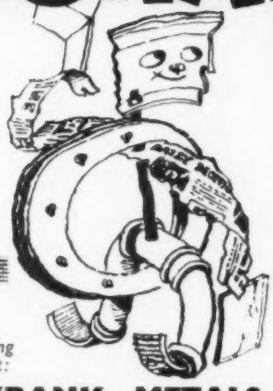


RAPID MAGNETIC LIMITED

LOMBARD STREET, BIRMINGHAM 12

✱ ELECTRO ✱ PERMANENT ✱ ELECTRONIC ✱ ELECTROSTATIC

Make Something out of Your... SCRAP



By contacting Mr. Neal at:

MAYBANK METALS LTD.

108 WOOTTON ROAD, WATERLOO, LONDON, S.E.1.
TELEPHONE: WATerloo 4110 or 7355

THE BUYERS OF NON-FERROUS SCRAP METALS

ONE OF THE

MAYBANK

GROUP OF COMPANIES

Branches at: Higginshaw, Portsmouth, Edmonton, Deptford, Woolwich, Oldham, Stroud, Gosport, Frindsbury, Soho.

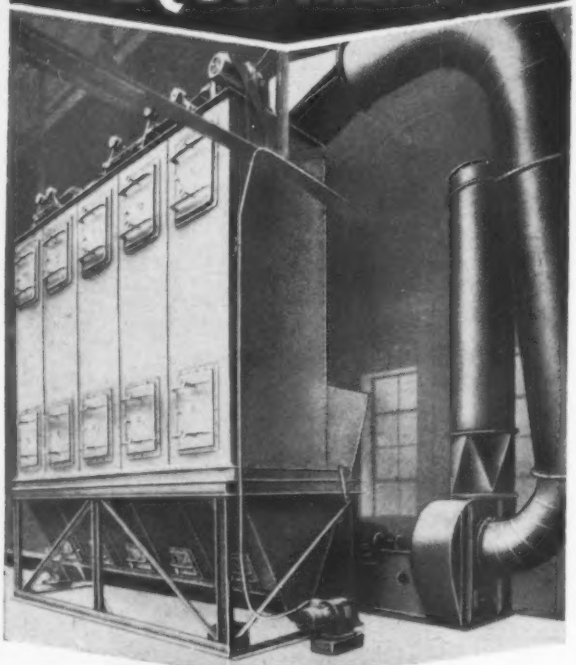
E.J. WILCOCK LTD

PRITCHETT ST · BIRMINGHAM 6

TEL · ASTON CROSS 3161·2·3

SOLVE YOUR DUST & SMOKE PROBLEMS WITH

INTENSIV FILTER EQUIPMENT



designed to meet your particular requirements—whether large or small.

"Intensiv" Dust Filters have been used by non-ferrous metal manufacturers and founders in Europe for over 35 years. During this long period they have been tested under all conditions and have given full satisfaction.

The range of equipments available in Great Britain is as follows:

INTENSIV — Bag Filter
INTENSIV — Chamber Dedusting
INTENSIV — Fans
INTENSIV — Cyclons
INTENSIV — Coolers
INTENSIV — Filtering Bags

INTENSIV—FILTER GMBH LANGENBERG/Rhl'd

Officially appointed representative in Great Britain

L. E. CROOKS
119 MOORGATE, LONDON, E.C.2.
MONarch 6518

IMPORTS MCE EXPORTS

M. C. ENGERS LIMITED LONDON

FOR ALL GRADES OF NON-FERROUS SCRAP METALS AND RESIDUES

40 JASMINE GROVE
PENGE
LONDON · SE20
PHONE · SYDENHAM 5126
GRAMS · OBENGERS SOUPHONE LONDON

DAVIES & CANN LIMITED PLYMOUTH

THE WEST COUNTRY'S LEADING MERCHANTS IN IRON, STEEL AND NON-FERROUS SCRAP METALS

Members of the National Federation of Scrap Iron, Steel and Metal Merchants and Allied Trades

MEMBERS OF THE NATIONAL ASSOCIATION OF NON FERROUS SCRAP METAL MERCHANTS

FREEMAN'S WHARF
CREMYLL ST.,
PLYMOUTH
PHONE · PLYMOUTH 4947
GRAMS · FERRO · PLYMOUTH

A real teaser

If there seems to be no way out of your particular problems call in the company with unequalled design and production experience in sheet metal fabrication and assembly

Specialists in design and complete unit production.

Camelinat

Member of the Owen Organisation

E. CAMELINAT & CO. LTD.,
CARVER STREET, BIRMINGHAM, 1
Phone: CENtral 6755 (5 lines)
Grams: Camelinat, B'ham.

An important book published for the Institution of Metallurgists

progress in metallurgical technology

Every year since 1947 The Institution of Metallurgists has held a refresher course for its members, presenting papers by four leading authorities. Although originally published only for Institution members, these papers were considered far too valuable for limited circulation; therefore it was arranged, beginning in 1956, to make them available to a wider public. The first three volumes under this scheme were warmly received, and the present volume is the fourth. The 1959 Refresher Course, which it covers, departs from the previous practice of dealing with one specialised subject. Instead, it reviews the current state of metallurgical technology over the wide field of extraction and refining, melting and casting, for both ferrous and non-ferrous metals. Recent developments and trends are also discussed. With this broadening of its appeal the book should be invaluable to chemists and engineers as well as to all metallurgists.

CONTENTS

Modern development in Iron and Steel production.
John Taylor, M.Sc., Ph.D., F.I.M.

Extraction and refining of non-ferrous metals.
A. V. Bradshaw, B.Sc., A.R.S.M., F.I.M.

Melting of ferrous and non-ferrous metals.
A. G. E. Robiette, D.Sc., F.I.M.

Casting of ferrous and non-ferrous metals.
D. V. Atterton, M.A., Ph.D., A.I.M.

32s 6d net (by post 33s 4d)
$8\frac{3}{4}'' \times 5\frac{1}{2}''$ 147pp. including 16 art plates.

from leading booksellers

Published by:— **ILIFFE Books Ltd Dorset House Stamford Street London SE1**

PHOSPHOR COPPER
AND ALL MASTER ALLOYS
MANUFACTURERS OF
NON-FERROUS METAL INGOTS
to all
REQUIRED SPECIFICATIONS
Prompt Deliveries
RHONDDA METAL Co. LTD.
PORTH GLAM.
TELEPHONE: PORTH 280
LONDON OFFICE:
I, HAY HILL, LONDON, W.1
TELEPHONE: MAYFAIR 4654

TRUST **LEAD**

The technical officers of the Association are always glad to give individual assistance

LEAD DEVELOPMENT ASSOCIATION
18 Adam Street, London, W.C.2
Telephone: WHitehall 4175
Telegrams: Leadevep, Rand, London

LDA 5/61

M. JOSEPH & SON
(BIRMINGHAM) LTD.

METAL MERCHANTS & MANUFACTURERS

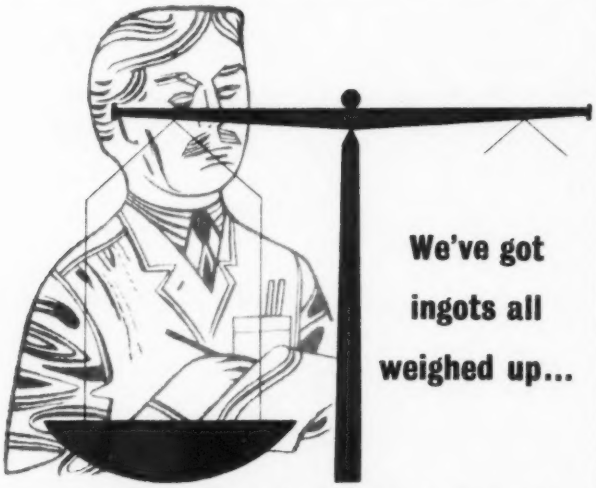
Buyers & Sellers of all Grades

NON-FERROUS METALS AND RESIDUES

Prompt Settlement, Collections and Deliveries.

MEMBERS OF THE NATIONAL ASSOCIATION OF NON-FERROUS SCRAP METAL MERCHANTS

10-12 BARD ST., SHAKESPEARE ST., SPARKHILL, BIRMINGHAM 11. *Telephone: VICTORIA 2264-5-6*



We've got ingots all weighed up...

....and have had for some time judging by the number of repeat orders simply asking for "same as before." We've long recognised the importance of consistency and — by taking great pains in every stage of production, make up, and analysis of each order — we believe we've ensured standards of the highest uniformity

It is all part of the policy which keeps us in the forefront of ingot metal manufacturers.

Chalmers *make sound ingots*

E. CHALMERS & COMPANY LIMITED
Newhaven Rd., Leith, Edinburgh, Scotland
Telegrams & Cables: "GILES" Edinburgh Telex
Telex 72-232
Telephones: 36611 (9 lines)

here comes the best metal—it's

AUSTINS

Austins have been 'Metal People' for nearly 90 years and still lead the field both at home and abroad. They have built up a reputation of being *the* people for non-ferrous metals, so why not approach them today if you require: Aluminium alloys, Copper alloys, Gunmetal, Aluminium Bronze, Manganese Bronze, Phosphor Bronze, Lead Bronze, Brass, Lead, Tin, Zinc, Solders, Typemetals.

AUSTINS NON-FERROUS METALS

E. AUSTIN & SONS (LONDON) LIMITED
Hackney Wick, E.9
Telephone AMHerst 2211
Telex: 22550 Optative London

BROCK
ZINC BASE ALLOYS

always
run
true
to
form

BROCK

METAL COMPANY LIMITED
BADGER WORKS, SALTLEY ROAD,
BIRMINGHAM, 7.
TEL: ASTON CROSS 1351-2

SPECIALISTS

IN ALL GRADES
OF NEW and OLD
NON-FERROUS
SCRAP METALS
and
RESIDUES

Members of The National Association of Non-Ferrous Scrap Metal Merchants.

IMPORT
EXPORT

Arthur E. Milner (METALS) LTD

DUNTON WORKS, KINGSBURY ROAD,
CURDWORTH, SUTTON COLDFIELD, WARWICKS.
Tel.: Curdworth 352/353. Grams: Telex 33-147
London Offices: City Wall House, 129/139, Finsbury Pavement, E.C.2.
Tel.: Monarch 5622. Cables: Milnamet, London.

ELSWICK BRAND

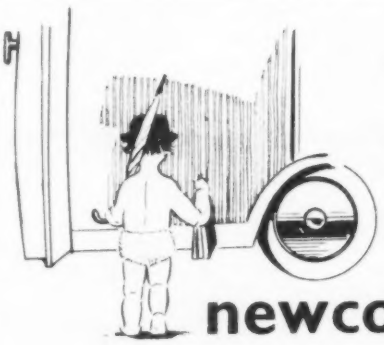
Aluminium Alloys

Pioneer manufacturers of the new high-strength age-hardening alloy 40-E (DTD.5008).

CASTING ALLOYS
To all specifications—A.I.D. release—Spectrographic Control.

STEELMAKERS' DE-OXIDISING GRADES
Buyers of all types of Aluminium Scrap including skimmings and residues.

ASSOCIATED LEAD
MANUFACTURERS LIMITED
ALUMINIUM DIVISION
CRESCENT HOUSE, NEWCASTLE



Are you a newcomer to the city?

— still flirting with various sources of supply for your aluminium alloy needs?
If so, you'll be glad to find one concern you can stay with — T. J. PRIESTMAN, for instance. We make it extremely difficult for a buyer to find an excuse for deserting us! The reasons are: TJP aluminium alloys are absolutely reliable, always consistent with specification, sensibly priced and promptly delivered. Let us forge a link with you that you won't want to break!

ALUMINIUM TPJ ALLOYS

SO MUCH THE BETTER

T. J. PRIESTMAN LTD.,
FORGE LANE, MINWORTH, SUTTON COLDFIELD
Tel. No.: ASHfield (B'ham) 1134

Rate: Advertisements set in run-on style **5d.** per word, minimum **5/–**. Semi-displayed announcements are charged at **27/6** per inch depth. Box Numbers: add 5 words, plus **1/–** for registration and forwarding replies. "Copy" accepted at London Office up to 1st post on each Friday for the following Friday's issue.

METAL INDUSTRY
CLASSIFIED ADVERTISEMENTS

Trade Discounts: Details upon application to "Metal Industry," Dorset House, Stamford Street, London, S.E.1. Remittances payable to "Metal Industry". The proprietors retain the right to refuse or withdraw "copy" at their discretion and accept no responsibility for matters arising from clerical or printers' errors.

APPOINTMENTS VACANT

METALLURGICAL Chemist required with experience in the analysis of Lead-, Zinc- and Copper-base materials. Some knowledge of Spectrograph an advantage. British or Continental birth should make enquiries with details to The Secretary, E.P.M. Ltd., Mill Green Road, Mitcham, Surrey. [8217

CAPACITY AVAILABLE

SURFACE Finishing of Contoured Parts, Internal and External, up to 12" dia. and 18" long. Elliptical, Square, Rectangular, Hexagonal, Octagonal, etc.
ARMYTAGE BROS. (KNOTTINGLEY) Ltd., Foundry Lane, Knottingley, Yorkshire. Telephone Knottingley 2743-4. [0001

LET us quote you for metal spinnings in all metals up to 25 in. blank. Wades (Halifax) Ltd., Arden Works, Fenton Road, Halifax. [0022

HEAT TREATMENTS

A.R.B.—D.G.I. APPROVED.
ELECTRO HEAT TREATMENTS LTD.
BULL LANE, WEST BROMWICH, STAFFS. Telephone No.: Wes. 0584-0756.
BRIGHT Annealing. Bright Hardening. Case Hardening. Carbo Nitriding; Gas Carburizing; High Frequency.
LIGHT Alloys: Solution; Precipitation, up to 10 ft.
CONTROLLED atmospheres for all treatments, including hardening, annealing and tempering of ferrous and non-ferrous alloys.
LABORATORY SUPERVISION.
LOCAL DELIVERIES. [0005

MATERIALS FOR SALE

NIMONIC Strip, approximately 1½ tons, 10½" wide × 0·020" thick. Cold Rolled, fully annealed in coil. Available for immediate sale; open to offers. Excellent condition. Still in original suppliers' cases. Telephone Crawley 26166, or apply in writing to F. H. Bourner & Co. (Engineers) Ltd., Manor Royal, Crawley, Sussex. [8220

3,736 LB. Spring Steel Wire, 0·134" dia. EN.49B Range 3, in coil; also 22 cwt. of similar Spring Steel Wire in 6 ft. straight lengths. £50 ton or nearest offer. Box 3924, c/o Metal Industry. [8218

PATENTS

THE Proprietor of British Patent No. 762130, for "An Improved Liquid Bath Furnace and Methods for Continuous Heat Treatment of Articles of Manufacture", desires to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2. [8221

PLANT FOR SALE

ROBERTSON Drum Coiler, 24" wide.
ROBERTSON Drum Coiler, 18" wide, with drive.
DECOILER, 18" × 10", with drive.
REED BROTHERS (ENGINEERING) LTD., Replant Works, Woolwich Industrial Estate, London, S.E.18. Tel. Woolwich 7611 (6 lines). [8223

50 kW EFCO High Frequency Melting Furnace and all ancillary equipment, comprising Alternating Set, Generator 2,000 cycle, 92½ amp., 600 volt, motor 440/3/50, capacitors, control panels, switches, etc., and two EFCO Desk type tilting Induction Furnaces, approx. capacity 1 cwt. Equipment about eight years old, in first-class condition and little used. Cost £6,000. Our price, £1,750. Can be inspected at Davidsons Engineers (M/cr.) Ltd., Irkdale Street, Smedley Road, Cheetham Hill, Manchester, 8. Telephone No. Collyhurst 1610. [8214

HUGO McGHEE (Metals) LTD.
NICKEL • SCRAPS
BOTH BUYERS & SELLERS
Westgate, Linley Lodge, ALDRIDGE.
Staffs. • • 53237/8

ENGINEER
EXTRUSION OF NON-FERROUS METALS

A vacancy has arisen in a rapidly expanding organization situated on the south west coast, for a Science or Engineering Graduate, who has some experience in the extrusion of non-ferrous metals, to be responsible for the development and control of the process. This can be an interesting and progressive appointment of a permanent character offering wide scope for a man of initiative. Applicants should state: Age, qualifications, experience and present salary, when replying to Box 3840, c/o Metal Industry.

KELLERING AND CAM PROFILING
capacity up to 8′ × 6′ or 6′ diameter
ARMYTAGE BROS (Knottingley) Ltd.
The Foundry
Knottingley, Yorkshire
Telephone - - Knottingley 2743/4

TUBES FOR SALE
several thousand per year

Self-bonded high grade silicon carbide tubes in 6" lengths 35 mm. o/d and 27 mm. i/d; also 10 mm. o/d and 6 mm. i/d. approximately. Properties: very hard, high thermal and electrical conductivity, good thermal shock and oxidation resistance at high temperatures. Box No. 3986, c/o Metal Industry.

PLANT WANTED

WANTED (Secondhand)—One water-cooled Air Compressor, delivery 60 cem. A 100 P.S.I. State price and where view. Brightside Plating Co. Ltd., Brearley Street, Birmingham. [8222

SCRAP METAL (SALE & WANTED)

URGENTLY REQUIRED
ZINC BASE ALLOY SCRAP
clean or contaminated
TURNINGS AND SKIMMINGS.
MITCHAM SMELTERS LTD.
REDHOUSE ROAD,
MITCHAM ROAD,
CROYDON, SURREY. [0008

SCRAP METAL (SALE & WANTED)

B. J. PERRY & CO. LTD.
Exchange Buildings, Birmingham, 2, for Phosphor Bronze Swarf and Scrap and all Non-Ferrous Metals.
Tel.: Midland 5986-7. [0113

NICKEL and High Nickel Content Scrap wanted. "Nimonics", "Inconel", "Monel", etc. Offer for best prices to Nicholson & Rhodes Ltd., Princess St., Sheffield, 4. Phone 27491. [0011

TENDERS

THE Director General of India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

	Quantity Tons
MILD STEEL SHEETS, Deep and Extra Deep Drawing Quality, in various sizes	2,320

FORMS of tender may be obtained from the above address on or after Friday, the 10th March, 1961, at a fee of 10s., which is not returnable. If payment is made by cheque, it should please be made payable to "High Commissioner for India". Tenders are to be delivered by 2 p.m. on Thursday, 20th April, 1961.
PLEASE quote Reference No. 43/60/RLY. [8219

TIME RECORDERS

FACTORY Time Recorders. Rental Service Phone Hop. 2239. Time Recorder Supply and Maintenance Co. Ltd., 157-159 Borough High Street, S.E.1. [0014

BOOKS

METALS and Alloys. Fifth Edition. This book contains approximately 4,600 compositions of non-ferrous alloy. It is mainly a list of alloys having definite names, including proprietary alloys, and it is indispensable to users of non-ferrous metals and alloys in any industry. 15s. net from all booksellers. By post 16s. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.
GAS Welding and Cutting: A Practical Guide to the Best Techniques. By C. G. Bainbridge, M.I.Mech.E., M.Inst.W. A comprehensive textbook providing practical information on almost the whole range of available gas welding and cutting equipment, methods and processes. Invaluable to the practical welder as well as to those responsible for gas welding and cutting operations involved in the fabrication and repair of industrial equipment. 15s. net from all booksellers. By post 16s. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.
PRODUCTION Engineering: Practical Methods of Production Planning and Control. By J. S. Murphy, A.I.I.A. This practical book deals with factory organization, each separate item or function being discussed in the order in which it arises in practice. The book provides experienced production engineers with an opportunity to compare different methods. 12s. 6d. net from all booksellers. By post 13s. 5d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.
METALLURGICAL Progress, 2 & 3. One of the most time-consuming tasks for the more advanced metallurgical student and research worker is "searching the literature". In these critical reviews, members of the staff of The Royal Technical College, Glasgow, not only review the existing work to date, but also discuss its relative value, so making their survey infinitely more valuable. As in the second series of critical reviews, the third volume presents a reasoned survey of the current state of research knowledge on various aspects of metallurgy. Seven articles by leading authorities present the information in concise, easily readable form. Series II 4s. 6d., Series III 6s. post free. From all booksellers or from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

ALUMINIUM
B·J·PERRY & CO. LTD
EXCHANGE BUILDINGS
BIRMINGHAM 2
TEL: MIDLAND 5986-7
Swarf & Scrap
and all **NON FERROUS METALS**

INDEX TO ADVERTISEMENTS

	Page
AEI-Birlec	—
Alcan (U.K.) Ltd.	—
Alexander Metal Co. Ltd.	—
Alkan Ltd., M. L.	—
Allan & Co. (Glenpark) Ltd., John	—
Alreco Metal Corporation Ltd.	—
Aluminium Bronze Co. Ltd.	—
Aluminium Corporation Ltd.	—
Anglo-Swiss Alum. Co. Ltd.	—
Armytage Bros. (Knottingley) Ltd.	19
Arnold, Edward	—
Ashby, Morris, Ltd.	—
Ashley Associates Ltd.	—
Associated Lead Manufacturers Ltd.	18
Associated Pressings Ltd.	—
Aston Tubes (Non-Ferrous) Ltd.	—
Atlas Metals & Alloys Co. Ltd.	—
Austin & Sons (London) Ltd., E.	17
Autocar	—
Auxiliary Rolling Machinery Ltd.	—
Barnett Ltd., H.	—
Batchelor Robinson & Co. Ltd.	—
Beta Ltd.	—
Birkett, Billington & Newton Ltd.	—
Birlec-Efco (Melting) Ltd.	—
Blackwell's Metallurgical Works Ltd.	—
Bolton & Sons Ltd., Thomas	—
Bond Ltd., Charles H.	—
Booth & Co. Ltd., J.	—
Brayshaw Furnaces Ltd.	—
Brightside Plating Co. Ltd.	—
British Aluminium Co. Ltd., The	—
British Electrical Development Association	—
British Furnaces Ltd.	*Outside back cover*
British Industrial Ingot Metals Ltd.	—
Brock Metal Co. Ltd., The	18
Bronx Engineering Co. Ltd., The	—
Brookes (Oldbury) Ltd.	—
Brooks & Co. (Metals) Ltd., T. J.	—
Brookside Metal Co. Ltd.	—
Buhler Bros.	—
Calorizing Corporation of Great Britain Ltd.	—
Camelinat & Co. Ltd., E.	14
Canning & Co. Ltd., W.	—
Capper Pass & Sons Ltd.	—
Carlsrud, Conrad M.	—
Carrs Paints Ltd.	—
Catterson-Smith Ltd., R. M.	—
C.A.V. Ltd.	—
Chalmers & Co. Ltd., E.	17
Chemical Construction (G.B.) Ltd.	—
City Casting & Metal Co. Ltd.	—
Cohen & Co. Ltd., A.	—
Coley & Son (Hounslow) Ltd., R. J.	4
Conder Engineering Co. Ltd.	—
Consolidated Zinc Corporation (Sales) Ltd.	12
Coulthard & Co. Ltd., William	—
Cramic Aircraft Components Ltd.	—
Crooks, L. E.	14
Cruickshank Ltd., R.	—
D.C.M.C. Industrial Aerosols Ltd.	—
Deutsch & Brenner Ltd.	—
D.M.M. Machinery Ltd.	—
Doncaster & Sons Ltd., Daniel	—
Easdale & Co. Ltd., R. M.	—
Electric Resistance Furnace Co. Ltd.	—
Electro-Chemical Engineering Co. Ltd.	—
Elton Levy & Co. Ltd.	—
E.M.B. Co. Ltd.	—
Engers Ltd., M. C.	14
English Electric Co. Ltd.	—
Enthoven & Sons Ltd., H. J.	—
Entores Ltd.	—
E.N.V. Engineering Co. Ltd.	—
Essex Metallurgical Ltd.	—
Eyre Smelting Co. Ltd., The	—
Farmer Norton & Co. Ltd., Sir James	—
Ferranti Ltd.	—
Firma-Chrome Plating Co. Ltd., The	—
Foundry & Metallurgical Equipment Co. Ltd.	—
Foundry Flux Ltd.	—
Franklin Furnace Co. Ltd.	—
Frost Ltd., N. T.	20
Garnham & Sons Ltd., J. B.	—
Gas Council, The	—
Geigy Co. Ltd., The	—
General Refractories Ltd.	—
German Industries Fair	—
Gibbons Brothers Ltd.	—
Gibbons (Dudley) Ltd.	—
Gills Pressure Diecastings Ltd.	—
Grauer & Weil Ltd.	—
Great Bridge Foundry Co. Ltd.	—
G.W.B. Furnaces Ltd.	1
Hadfields Ltd.	—
Hall Foundries Ltd.	—
Hall Street Metal Rolling Co. Ltd.	—
Hampton Works (Stampings) Ltd.	—
Harris (Birmingham) Ltd., F. W.	—
Harris Plating Works Ltd.	—
Harshaw Chemicals Ltd.	—
Head Wrightson Machine Co. Ltd.	—
Hedin Ltd.	—
Heneage Metals Ltd.	—
Hilger & Watts Ltd.	2
Hockley Chemical Co. Ltd.	—
Holroyd & Co. Ltd., John	5
Ilfar Aluminium Co. Ltd.	—
Iliffe Books Ltd.	—
Imperial Aluminium Co. Ltd.	*Outside front cover*
Imperial Chemical Industries Ltd.	—
Incandescent Heat Co. Ltd., The	—
Industrial Research Laboratories	—
International Alloys Ltd.	6
International Refining Co. Ltd.	—
Johnson & Co. (Birmingham) Ltd., George	—
Johnson & Co. Ltd., T. W.	13
Johnson & Sons Smelting Works Ltd.	—
Jones & Co. Ltd., R.	—
Jones & Rooke (1948) Ltd.	—
Jones Ltd., George	*Inside back cover*
Joseph & Sons Ltd., M.	17
Laidlaw Drew & Co.	—
Lazarus Ltd., Leopold	—
Lead Development Association	16
Levick Ltd., John	—
Lindemann Maschinenfabrik G.m.b.H.	—
London & Scandinavian Metallurgical Co. Ltd.	—
McGhee (Metals) Ltd., Hugo	19
McKechnie Bros. Ltd.	—
Magnesium Elektron Ltd.	—
Manganese Bronze & Brass Co. Ltd.	—
Marshall Richards Machine Co. Ltd.	—
Maybank (Metals) Ltd., J. & J.	15
Metal Castings Ltd.	—
Metal Distributors (U.K.) Ltd.	—
Metallic Extractors (Non-Ferrous) Ltd.	—
Metals & Methods Ltd.	—
Midland Metallics Ltd.	—
Midland Monolithic Furnace Lining Co. Ltd.	*Inside back cover*
Milner Metals Ltd., A. E.	18
Mint, Birmingham, Ltd., The	—
Mitcham Smelters Ltd.	—
Modern Furnaces & Stoves Ltd.	—
Mond Nickel Co. Ltd., The	—
Monometer Manufacturing Co. Ltd.	8
Morgan Crucible Co. Ltd.	3
Morris Ltd., B. O.	—
National Industrial Fuel Efficiency Service	—
New Metals & Chemicals Ltd.	—
Newton Collins Ltd.	—
Nickel Anodes & Non-Ferreous Castings Ltd.	—
Northern Aluminium Co. Ltd.	—
Nu-Way Heating Plants Ltd.	4
Oakey & Sons Ltd., John	—
Ormerod Ltd., R. E.	—
Park & Paterson Ltd.	—
Peco Machinery Sales (Westminster) Ltd.	—
Perry & Co. Ltd., B. J.	19
Platt Metals Ltd.	10
Powder Metallurgy Ltd.	—
Priestman Ltd., T. J.	18
Rapid Magnetic Ltd.	15
Rhondda Metal Co. Ltd.	16
Robertson & Co. Ltd., W. H. A.	—
Rollet & Co. Ltd. H.	—
Roper & Co. Ltd., E. A.	—
Schieldrop & Co. Ltd	—
Schloemann, A.G.	—
Senior & Co. Ltd., T. W.	*Inside front cover*
Sheffield Smelting Co. Ltd.	—
Shell-Mex & B.P. Gases Ltd.	—
Sheppard & Sons Ltd	*Inside front cover*
Silvercrown Ltd.	—
Simpson (Assayer) Ltd., Gordon	—
Sklenar Furnaces Ltd.	7
Smith & Sons (Clerkenwell) Ltd., J.	—
Stedall & Co. Ltd.	—
Stein & Atkinson Ltd.	—
Stein & Co. Ltd., John G.	—
Strebor Diecasting Co. Ltd.	—
Stuart (London) Ltd., Robert	—
Tancred & Langley Ltd.	9
Thermal Syndicate Ltd.	—
Threadgill Electro Deposits Ltd.	—
U.K.A.E.A.	—
Union Carbide Ltd.	—
United Coke & Chemicals Co. Ltd.	—
University of Nottingham	—
Urquhart's (1926) Ltd.	—
Vickers-Armstrongs (Engineers) Ltd.	—
Ward Ltd., Thomas W.	—
Western Diecastings Ltd.	—
West Instrument Ltd.	—
West Yorkshire Foundries Ltd.	—
Westinghouse Brake & Signal Co. Ltd.	—
Westland Aircraft Ltd.	—
Wilcock Ltd., E. J.	15
Wilkes Chemical Co. Ltd., Henry	—
Wilkins & Mitchell Ltd.	—
Williams Brothers & Piggott Ltd.	—
Wolverhampton Metal Co. Ltd.	—
Wolverhampton Trading & Scrap Co. Ltd.	—
Wright, Bindley & Gell Ltd.	—
Yorkshire Engineering Supplies Ltd.	—
Young Ltd., T. W.	*Inside back cover*
Zinc et Alliages	—

N.T. FROST LTD.

ELECTROPLATERS

THE SPECIALIST ELECTROPLATERS OF SMALL WORK IN QUANTITIES

FULLY APPROVED A.I.D.

ALL FINISHES

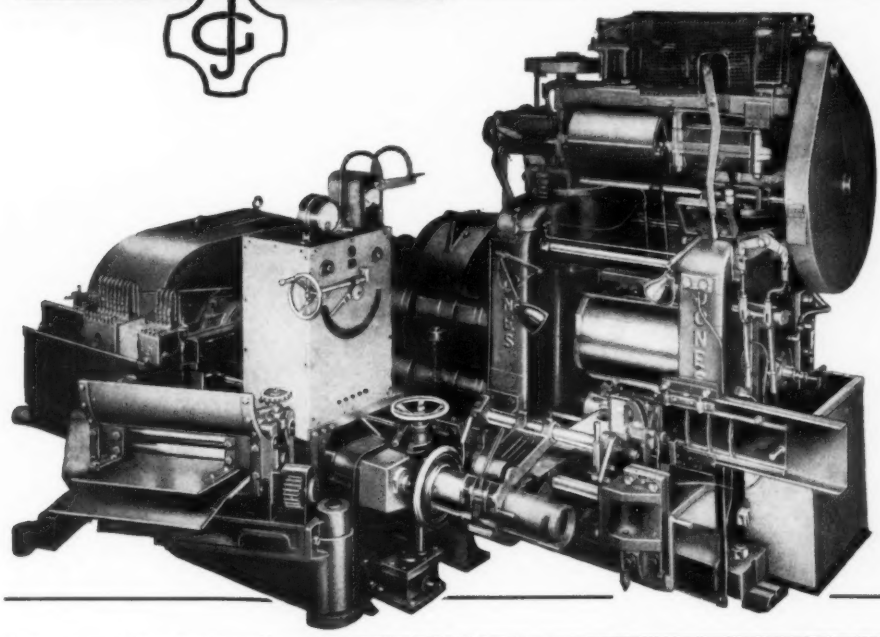
HARFORD ST. BIRMINGHAM 19 Tel. CEN 4135 (6 lines)

Printed in Great Britain by James Cond Ltd., Charlotte St., Birmingham 3. Published by Iliffe Production Publications Ltd., Dorset House, Stamford St., London, S.E.1

GEORGE JONES LIMITED

ROLLING MILL ENGINEERS AND HEAVY IRON FOUNDERS

LIONEL STREET FOUNDRY
BIRMINGHAM 3
Telephone: CENtral 1003-4



Manufacturers of
ROLLING MILLS
SHEARS
COILERS
INGOT MOULDS
TURNTABLES
for the non-ferrous Metal Industry

REDUCTION GEAR UNITS TO TRANSMIT UP TO 400 H.P.

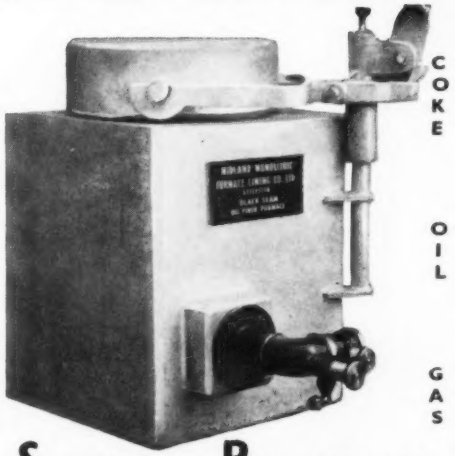
MACHINE MOULDED GEAR WHEELS UP TO 14 ft. DIA.

GENERAL IRON CASTINGS UP TO 6 TONS

HEAVY MACHINING CAPACITY

BLACK SEAM CRUCIBLE FURNACES

COKE OIL GAS



COKE OIL GAS

SUPERIOR PERFORMANCE

FACTORS :	
FAST MELTING	Gain of 15 mins/hour
FUEL	25% saving
CRUCIBLES	15% longer life
TEST BARS	Specification assured

Free demonstration at your works.

MIDLAND MONOLITHIC FURNACE LINING CO. LTD.
GOOSE LANE, BARWELL, LEICESTER
Telephone: EARL SHILTON 2061/2 (2 lines)

Copper, Brass and Aluminium in Sheets, Tubes, Rods and Wire

DELIVERIES FROM STOCK

T. W. YOUNG LTD.

105 GOSWELL ROAD, E.C.1

Phone: Clerkenwell 2241/2 Grams: Wuzog, Barb.

ANNEALING FURNACES FOR NON-FERROUS MATERIALS

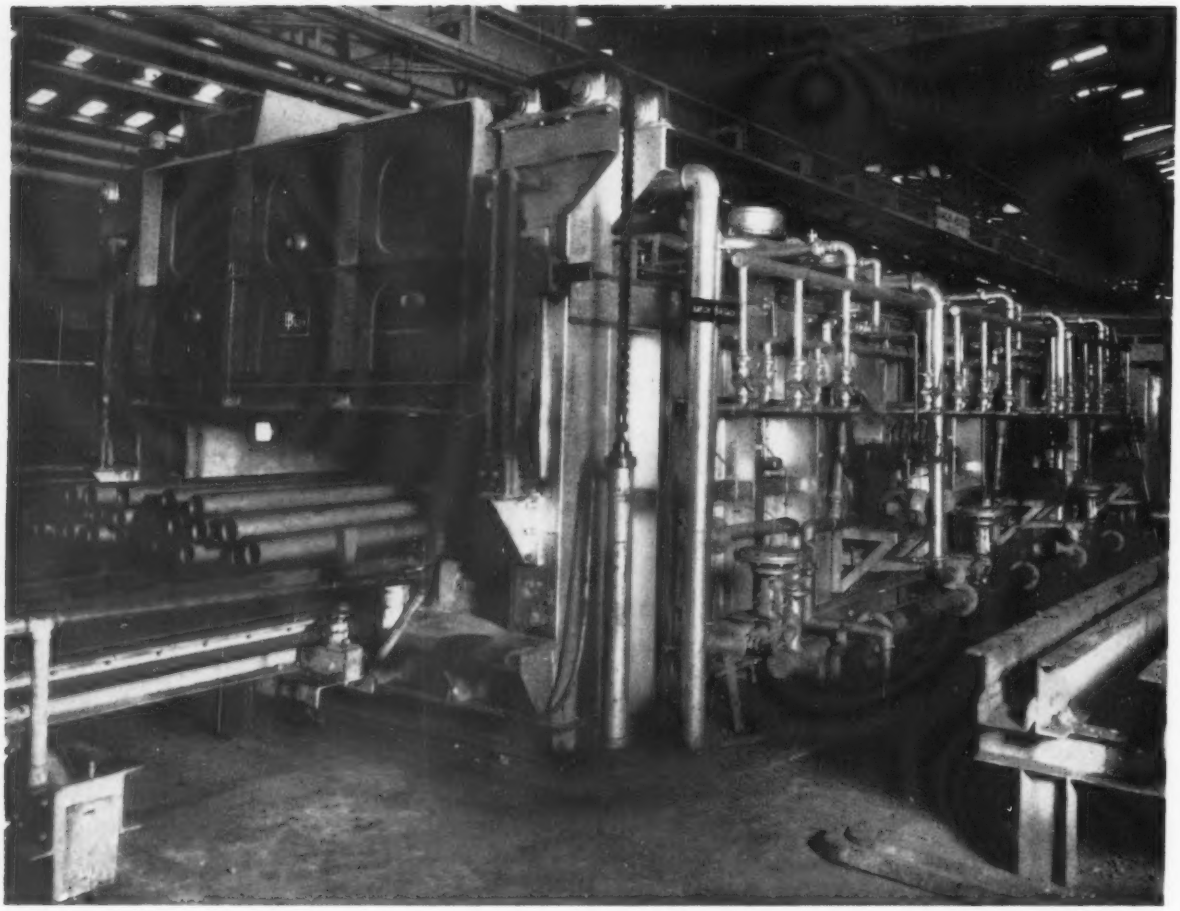


Illustration by kind permission of The Yorkshire Imperial Metals Ltd.

Batch Type Annealing Furnace, Town's Gas Fired. 8′ 0″ wide × 30′ 0″ long for non-ferrous tubes, operating temperatures 250°-800°C. Output 3 Tons per hour. Automatic proportioning gas burners give atmosphere control with uniformity of temperature and economy in operation.

BRITISH FURNACES LIMITED — CHESTERFIELD

Associated with SURFACE COMBUSTION CORP. — Toledo — U.S.A.